BROOKLYN BOTANIC GARDEN

PLANTS & GARDENS

BROOKLYN BOTANIC GARDEN RECORD

PLANTS & GARDENS

SPRING
1962

Wild Flowers
Trees and Shrubs
of
The Northeast
N. J. Pine Barrens
Southeast
Rocky Mountains
Arid West
California
Northwest
Great Plains
The Ozarks

How to Grow and
Propagate Them

Where to See
Them
Growing Wild

NEW SERIES
Vol. 18 No. 1

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Roche

BLOODROOT (*Sanguinaria canadensis*), one of the earliest and most delightful of spring wild flowers, adapts well to culture in woodland gardens from Canada to Florida and westward to the Plains region.

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Spring 1962

For those of us who love natural things, the very words "wild flowers" stir a yearning for return to never-forgotten moments, or places—where gems of the floral wild first made their silent bid for our affection. These might have been cowslips beside a brook, wood anemones on the forest floor, or beauties in the desert or the mountains. Wherever they grew, the image remains and with it a certain understandable nostalgia. Many other wild things fail to touch the heart. Pick up a current magazine and read an account of "War Against the Insects." Insects too are wild, many of them exquisitely beautiful, yet traditionally they are linked with man's troubles and for a variety of reasons seem to lack universal appeal. Just what is it that attracts us to some of Nature's bounty, while other wildings repel? There is food for thought and discussion here.

Editor Helen Hull has selected an impressive group of contributors to this Handbook. Because there are many authorities on native plants, she confined the selection to those known to her. They are pioneers in this field. As Mrs. Hull puts it, "they represent a special breed and, when they are gone, may not be replaced." It is her hope, as well as ours here at the Botanic Garden, that in inviting this galaxy to contribute their life-long experience, the Handbook will in turn be a tribute to them. Almost all are amateurs at heart, in the best sense of the word. They are lovers of our native flora, but have earned a living in other ways. Many are "old timers." They have deep knowledge, and each has written at least one authoritative book on the subject.

The object of this Handbook is to present a glimpse of our native flora and to stimulate an interest in its preservation—through growing native plants in gardens. Mrs. Hull's problem was to screen, to narrow, to confine, and yet present a picture of the great bounty of our native wild flowers. Out of some 25,000 plants that grow wild in this country, only those best known and most adaptable to the widest range of gardens could be included here. This immediately cut out consideration of some of the rarest and most beautiful.

In addition to a fine array of illustrations, readers of the Handbook will find good cultural suggestions for growing wild flowers in many different regions.

As bulldozers roll into wild or open land across our country at the rate of some seven square miles per day to make way for the works of man, we have a rather special responsibility to preserve our natural heritage. Not everyone can help in this, but those so-minded and with space for a garden can play an important part. Let nothing worthy disappear from the face of the earth because man "just didn't think" in time.

Sincerely,

George D. Aiken

Director

Color reproductions arranged through The Massachusetts Horticultural Society.

Map of the United States showing areas of wild flowers that are the subject of this Handbook.

INTRODUCTION

In this handbook, native plants are defined as species indigenous to continental United States with their variations and natural hybrids. The possibilities for gardening with native plants differ from region to region, from habitat to habitat, and depend upon the available conditions of soil, light, temperature, moisture and in some areas, wind. Those regions represented are roughly indicated on the map above.

In addition to its variation with natural conditions, gardening with native plants as here presented embraces diverse individual concepts. Would a species native to Colorado be considered a "native plant" in New Jersey? Can wild flowers be grown together with cultivated plants? Why do we grow native plants if there are flowers from other areas of the world, larger, more spectacular, and possibly easier to grow than some of the treasures of our own land? Debate on these questions could fill the pages of this handbook. The objective, however, is not argument, but discussion, rather, to present various experiences of gardening with native plants for interest and esthetic pleasure; to foster an awareness of the beauty and bounty of our floral heritage; and to encourage the preservation of our native plants for future generations. Urbanization of the countryside, draining of wetlands and clearing of forests, all spell doom for species of wild plants which for millions of years before the coming of man managed their own development and survival. The beauty of these plants which have evolved in nature lies in their perfection of form, their exquisite colors and textures and their marvelous adaptations for conditions as they find them. From the tiny stars of pixie-moss, which must be examined with a hand lens to be appreciated, to the giant saguaro cactus blooming 25 feet above the Arizona desert, the enjoyment of these beauties and acquaintance with their ways, suggests to the devotee that in the mysteries of these plants may lie the secrets of our own being.

Helen S. Hull

WILD-FLOWER GARDENING IN THE NORTHEAST

Kathryn S. Taylor

INTEREST in wild-flower gardening is on the increase. In terms of conservation, this is a fortunate circumstance since without intelligent assistance some of our country's choicest and decorative native plants may be doomed to extinction. Spring flowers seem to have the greatest appeal to gardeners, but the summer and fall ones should not be neglected, for these make it possible to have a good display of bloom straight through the season.

The wild-flower gardener with an unspoiled natural habitat does not need to be told what to grow. He will carefully tend the plants already there, and will probably add only other species which may occur in the same general area. But if a wild-flower garden is created artificially, it is not necessary to confine oneself to plants indigenous to a limited locality. Appropriate species from distant places that fit into the garden picture can more than compensate for the man-made setting.

This article limits itself to species which can be safely transplanted from the wild, bought from wild-flower nurseries or propagated from seeds or cuttings.

It is assumed that the spring garden is situated where there is a reasonable amount of moisture and some shade from deciduous trees. Few of the delicate and fleeting early-flowering species can tolerate full sun and dry soil. If there are no trees large enough to cast shade in a new garden, wild flowers will grow happily with a protective roof of laths or brush until native trees and shrubs have a chance to establish themselves.

Probably the earliest desirable spring wild flower is hepatica. Large clumps are sometimes seen in semi-shady rock gardens where the stones and the sloping terrain give the plants the cool root run and good drainage which they require. Rodents may devour the blossoms, thus preventing the plants from seeding themselves, which they would surely do if contented. The color of the flowers borne on short, silky-haired stems varies from white and pink to a deep lavender blue. The three-lobed leaves are distinctive. If rocks are made a part of the wild garden they provide a congenial home for wild columbine, anemones, dwarf phloxes, dwarf irises, small ferns and many other species.

Ground Covers

Trailing-arbutus (*Epigaea repens*), known to everyone, is another early-flowering favorite. It must have very acid soil, well drained, not rich but with adequate organic matter, and be placed where it receives some sunlight when in

DUTCHMAN'S-BREECHES (*Dicentra cucullaria*) can be colonized on shady slopes.
Roche

flower. It can stand shade for the rest of the season. Unless the soil is naturally quite acid it is difficult to keep the acidity high enough over a period of time and the plants then languish and gradually die out. They appreciate a yearly mulch of rotted wood or very old manure and will rapidly form large mats making a fine ground cover if well placed.

The beautiful southern Oconee-bells (*Shortia galacifolia*) likes similar treatment and is a real treasure to acquire. Other attractive ground covers needing acid soil are fringed polygala (*P. paucifolia*), checkerberry (*Gaultheria procumbens*) and partridge-berry (*Mitchella repens*). The polygala takes years to become established.

There are several indispensable spring-flowering ground covers which prefer a more neutral soil and they may flourish where it is not possible to satisfy acid-loving plants. These include spring-beauty (*Claytonia virginica* and *C. caroliniana*), wild ginger (*Asarum canadense*), foamflower (*Tiarella cordifolia*) and miterwort (*Mitella diphylla*). Dutchman's-breeches (*Dicentra cucullaria*) and squirrel-corn (*D. canadensis*) form large colonies on cool, stony hillsides where their rows of nodding white or pinkish flowers on leafless stalks contrast well with the delicate lacy foliage. Rodents love all parts of these plants. Many of the trout-lilies or dog's-tooth violets (*Erythronium*) also succeed in neutral or slightly acid soil. The eastern species may not bloom well for several years after planting, but those from farther west behave much better. They should be in every wild-flower garden. In open places the cinquefoils, especially *Potentilla tridentata*, will catch the sun in their small, gleaming yellow petals.

Bloodroot (*Sanguinaria canadensis*) and its handsome double form will increase rapidly with no special attention. Jack-in-the-pulpit (*Arisaema triphyllum*), enjoyed by everyone, is equally easy to introduce and self-sows readily. The brilliant red, fleshy fruits add an unexpected bit of color in late summer.

No spring wild-flower garden is complete without trilliums, beginning with the little snow or dwarf trillium with stems about five inches tall and flowering sometimes in late March. Trilliums do best in rich leaf-mold on shaded hillsides; good drainage is essential, although they are moisture-loving plants. This and the beautiful large white trillium (*Trillium grandiflorum*) are found more commonly in nature, west and south of New England. This large species is easy to establish, spreading into good colonies which are truly permanent. The nodding trillium (*T. cernuum*) also has white flowers which are not conspicuous because of their position nearly hidden beneath the large leaves. Purple trillium (*T. erectum*) is even easier to grow and can be obtained in a yellow form. There is also a white form of *T. erectum* with a purple center. The forms are native in the South but are hardy in New England. Another southern species is *T. sessile* with mottled leaves and peculiar maroon or yellow-green blossoms more unusual than attractive. *T. luteum*, yellow and fragrant, is another interesting species. The western

NODDING TRILLIUM (*Trillium cernuum*), one of the many trilliums that are easy to grow in shady gardens from coast to coast.
Gottscho-Schleisner

Henry M. Mayer from NAS

CANADA LILY (*Lilium canadense*), tall and stately, grows in meadows where undisturbed.

natives such as *T. oratum* and *T. californicum* can also be grown in the East.

Other showy spring wild flowers which will colonize in a variety of habitats are Virginia-bluebells (*Mertensia virginica*), Jacob's-ladder (*Polemonium reptans*), May-apple (*Podophyllum peltatum*), great merry-bells (*Urularia perfoliata* and *U. grandiflora*). When the gardener has become really experienced, special places can be prepared for those orchids which can safely be transplanted, the yellow *Cypripedium calceolus* var. *pauciflorum*, also var. *pubescens*, and *C. reginae*, the showy lady's-slipper, true aristocrats of the wild garden. Only gardeners lucky enough to have such plants as the pink lady's-slipper (*Cypripedium acaule*) already growing on their property can hope to maintain permanent plantings. Even these may eventually disappear for no apparent reason.

Many wild flowers are grown fully as much for decorative foliage as for the flowers and attractive fruits which some produce. The baneberries (*Actaea pachypoda* and *A. rubra*), blue cohosh (*Caulophyllum thalictroides*), Solomon's-seal (*Polygonatum*) and false Solomon's-seal (*Smilacina racemosa* and *S. stellata*) are good examples and are easily grown.

As the season progresses interest in the spring wild-flower garden gives over to the wild flowers of early summer, most of which flourish in full sun and drier soil. Among the most desirable of these are species which can be made an important part of the cultivated border. The smooth white penstemon (*P. digitalis*) with panicles of tubular white flowers and attractive dark green leaves is an asset in any garden. Butterfly-weed (*Asclepias tuberosa*) with its bright orange-yellow flowers in umbels delights in poor sandy soil and full sun. As a companion for some of the hybrid lilies such as 'Enchantment' it has great garden value. The white form of musk mallow (*Malva moschata*) is useful as a filler and will grow anywhere.

For the midsummer wild-flower garden

YELLOW LADY'S-SLIPPER (*Cypripedium pubescens*), most adaptable of the cypripediums in cultivation; light shade.

Roche

William J. Jahoda from NAS

CLOSED GENTIAN (*Gentiana andrewsi*), a perennial easily established in moist situations.

the lobelias (*L. cardinalis* and *L. siphilitica*), with their occasional white forms, are unexcelled. The behavior of cardinal-flower under cultivation is surprising. The plants self-sow freely under conditions of shade, sun, moisture or dryness and create quite a spectacular display. The other, the great blue lobelia, behaves in much the same way and lasts in flower well into fall. Turk's-cap lily (*Lilium superbum*) is the easiest native lily to bring into the wild-flower garden and it often grows to surprising heights. The Canada lily (*L. canadense*), even more beautiful, is apt to be finicky. The tall Culver's-root (*Veronicastrum virginicum*)

with spikes of small white flowers and handsome whorls of leaves around the stems is another splendid background plant. Swamp rose-mallow (*Hibiscus moscheutos*) does not require wet ground and deserves wider use for late summer color. Where yellow flowers are welcome compass plant (*Silphium perfoliatum*) and single goldenglow or coneflower (*Rudbeckia laciniata*) are valuable accent plants with green leaves right to the base of the stems. Physostegias—several species—are attractive summer flowers, especially the giant *P. digitalis*, with tall spires of flowers like lavender pearls. These grow well in full sun, with some moisture.

With the advent of fall the gentians and the best of the asters, goldenrods and other composites take over the wild garden. If the soil is about neutral the closed gentian (*Gentiana andrewsi*) multiplies freely in a moist spot in sun or part shade. Anyone with a wet, sunny, grassy meadow should consider it an obligation to introduce plants of fringed gentian (*Gentiana crinita*) which in a few years will form sheets of blue and become the glory of the fall garden.

Often water is introduced into the wild-flower garden with a pool or little brook. A small sunny bog made by building a leaky wall across one end of a pool and filling the depression with peaty soil with a deep layer of live sphagnum on top will provide suitable quarters for pitcher-plants (*Sarracenia purpurea*), meadow-beauty (*Rhexia virginica*) and such ground covers as goldthread (*Coptis groenlandica*), creeping snowberry (*Gaultheria hispidula*), and small cranberry (*Vaccinium oxycoceos*). Wild calla (*Calla palustris*) planted on the edge will creep into shallow water.

By using his ingenuity the wild-flower gardener can supply a surprising variety of habitats where many choice natives will feel at home if handled with patience and understanding.

SWAMP ROSE-MALLOW (*Hibiscus moscheutos*) will grow in sunny garden soil.

Molly Adams

A DOZEN OR SO FAVORITE FLOWERING TREES

For the Eastern United States

John C. Wister

McFarland

FLOWERING DOGWOOD (*Cornus florida*), picturesque in woods from Maine to Florida and westward to Texas.

IN gardening circles the term "flowering trees" usually refers to medium-sized trees (as distinguished from large shade trees like oaks and maples) which are planted in gardens because they have conspicuous ornamental flowers. All of the trees mentioned in this article are in this category.

No single species will do well in all parts of this vast continent. The ones discussed here can be grown from New England south to the Carolinas and west to Tennessee, Kentucky, Missouri, Michigan, and Illinois.

Whenever anyone publishes a list of favorites, there is immediate disagreement from those who feel that important kinds have been left out or inferior kinds recommended. There will always be such differences of opinion. I hope a good many of my readers will agree with me that any one of the trees here mentioned is well worth growing, even in a small garden.

My first choice is the flowering dogwood (*Cornus florida*). It is native from Maine to Florida and Texas, but is not recommended for the extreme north or for the cold central states west of Chicago. In its natural area it beautifies great hillsides with its flowers in the spring; then again in autumn with its brilliant red foliage and fruit. Its individual flowers (really bracts: the small central flowers are inconspicuous) are two to three inches across. The red berries are about a quarter of an inch long and are borne in clusters.

The dogwood adapts itself readily to garden and suburban conditions, either as a specimen tree or in a group of trees and shrubs. It will grow either in partial shade or full sun, and is not particular as to soil, though it responds well when humus and a balanced fertilizer are added.

The fact that pink dogwoods are so widely advertised by our nurseries, indicates that they either appeal to the gar-

McFarland

REDBUD (*Cercis canadensis*), with magenta-pink flowers; blooms with dogwood and shadbush, in early spring.

dening public or that the nurseries hope, by featuring them, to get higher prices. I much prefer the white forms. It should be noted that many shades of pale pink-flowered dogwoods occur in the wild.

Next to the flowering dogwood, I would place some of our native flowering crab apples. They are hardier than dogwood and grow well all over our central west and even in the severe climates of Minnesota, the Dakotas and Canada.

In the New York City area, the American crab apples bloom in mid- or late May, a week or even two weeks later than the Asiatic crabs. The individual flowers are rather larger than those of the Asiatic crab apple, but they are not borne in such profusion. In well grown specimens they do, however, literally cover the tree and make wonderful garden pictures. The buds are pinkish and the flowers open lighter, much like the ordinary fruiting apples. They do not have the wide color range of the Asiatic crabs. I think this is a good thing as I do not happen to like the muddy purple magenta tones of some of the Asiatic crabs, which are so much advertised and planted.

Malus coronaria, commonly called wild sweet crab apple, grows from Ontario and New York to Alabama and Missouri. It attains a height of about 30 feet. One very fine double pink and very fragrant form is 'Nieuland,' which is only now reaching the general nursery trade. From the Allegheny Mountains west, *Malus coronaria* is replaced by the Iowa crab (*Malus ioensis*). While it may in time grow equally large, it is usually seen as a dwarfer or much slower-growing plant. The wild type is not often seen in gardens, which is a great pity. It is, however, represented by the most popular of flowering apples, the Bechtel crab. This has double roselike flowers of the loveliest possible pink and of the most wonderful fragrance. It is featured by many nurseries and planted in great numbers. Unfortunately, it hardly ever lives long enough to attain great size and is commonly only 10 to 12 feet high. The late E. H. Wilson insisted that this was be-

SHADBUSH (*Amelanchier canadensis*). Misty white blossoms before green leaves appear.

McFarland

McFarland

FLOWERING CRAB APPLE (*Malus coronaria*) is the wild sweet crab of the eastern states.

cause it was grafted on an incompatible stock, but apparently nurserymen have not yet offered plants grafted on a stock that has proved superior. Gardeners can only buy what the nurserymen grow, and therefore, for the present at least, we have to consider the Bechtel a short-lived tree.

A third apple (*Malus angustifolia*), the southern crab, is the last to bloom. At Swarthmore, it forms a rather more vase-shaped tree than the others. It has a fine double form, 'Prince Georges,' which is wonderfully fragrant.

In many sections of the country there are dozens of species of American hawthorn and they are often liked and admired as much as the native crab apples. The tiny white flowers, in clusters several inches across, are borne in such profusion that they make splendid masses in the landscape. Closely viewed, they lack the form and exquisite beauty of the apples, but they have the added value of a brilliant autumn color display. For those who are particularly interested in this genus, species can be selected which produce brilliantly colored fruits, varying from yellow through orange to red, or even shiny black. In some species the fruit colors as early as September and in others not until after severe frost. Occasional forms are found on which the fruit hangs on and keeps its color into late winter. This great and complicated genus is so difficult to understand that very few gardeners have learned or ventured to grow many of the wild species. Probably not more than half a dozen or a dozen are to be found in American nurseries. The best known is the cockspur thorn (*Crataegus crus-galli*). Its flowers, like those of the other American thorns, are white and its fruits, a half-inch or more across, are brilliant red in the autumn. Very different from this, and perhaps making a more brilliant display of autumn color although the fruits are comparatively small (less than a quarter inch) is the Washington thorn. *Crataegus phaenopyrum* is the name which the modern botanists wish us to use for this species instead of the more easily spelled and pronounced *Crataegus cordata,* by which it used to be known and by which it is still often listed in nurseries.

Closely related to the apples and hawthorns is our American mountain-ash (*Sorbus americana*). It likes cold climates and does better in northern New England and the Adirondacks than in New Jersey and states farther south. Outside its natural climatic range it seems to be particularly susceptible to borer injury and, in eastern Pennsylvania recently, Japanese beetles seem to have taken a special fancy to it. In spite of these two drawbacks, however, I still consider it well worth growing. Its main display is, of course, its autumn fruit.

A good many gardeners would pick the redbud or Judas tree (*Cercis canadensis*), as a worthy companion to the dogwood. Indeed, it is found over much of the same territory, growing with dogwood in our forests. Its magenta-pink flowers, which can be so difficult to use with other pinks in gardens, are in nature effectively balanced by the white of the dogwoods to beautify vast wild areas. I do not, however, personally place it too high on my list of favorite trees because in the

Roche

SILVERBELL (*Halesia carolina*). Native to southern Appalachians but hardy in northern gardens, where it may be cultivated as a tree, or by judicious pruning kept as a large shrub.

Middle States where I have done most of my gardening work, it does not seem to flourish for many years. It is apt to grow very quickly to a height of 10 to 15 feet and then die back suddenly to the ground. This has been true also of the very lovely white form now offered by some nurseries. I fear it may be true of the new and highly recommended clear rosy pink form which has not yet been widely distributed.

The sweet-bay (*Magnolia virginiana*), still widely known under its former botanical name *Magnolia glauca*, grows all the way from Florida north to Massachusetts. Some 30 miles north of Boston, the town of Magnolia was named for a particularly fine wild stand. It is usually seen as a small tree 15 to 18 feet high, but in time it reaches 30 or 40 feet. The flowers are borne after the foliage comes out and therefore do not make the extraordinary display of the Chinese magnolias and their hybrids. They do however open intermittently over a long period of bloom in May and June, and they are delightfully fragrant. The underside of the leaf is very pale, giving a contrast of color when the wind blows. In the deep South, the foliage is evergreen, but this is unusual from Virginia north.

Southern gardeners will, of course, want *Magnolia grandiflora*. It makes a very large tree up to 75 or 100 feet; thus in contrast to the other trees that have been mentioned, it is suited only to the larger garden. It cannot be relied upon much farther north than Washington or Baltimore, although occasional splendid specimens are to be found in eastern Pennsylvania and New Jersey, and one forty-foot specimen is growing in New York City's Borough of Brooklyn, and a small specimen in the Brooklyn Botanic Garden. It is hoped that by breeding and selection, forms will be found that are hardier in New York or even farther north. At present only a few of these are known and they have not been tested long enough to demonstrate whether they can become important to the ordinary gardener.

There are two silverbells to be consid-

ered. The one best known is *Halesia carolina,* which is often considered a large shrub although it will grow up to 30 feet in height, and grows with a single stem as often as it does with multiple stems. Though its flowers are usually white, occasional pink-flowered trees occur in the wild. The other species (not now widely grown, at least in the North) is *Halesia monticola,* which grows to 80 or often 100 feet in the southern mountains.

The shadbushes, or shadblows as some prefer to call them, include not only many beautiful shrubs but at least two trees that will reach heights of 30 to 40 feet. They bloom in early spring and the plants are covered with small flowers that give a feathery misty-white effect in the landscape. The first of these, *Amelanchier canadensis,* is the largest and finest. The other tree form, *Amelanchier laevis,* which does not grow quite so tall, is also valuable in gardens. Both of these species bear reddish to bluish fruits in early summer, giving rise to the common names of June-berries and sugar-berries. These fruits are relished by children as well as by birds.

The latest blooming of the flowering trees to be mentioned here is the sourwood or sorrel-tree, *Oxydendrum arboreum.* It may grow quite tall—up to 75 feet in its native southern mountains—but in cultivation is seldom seen more than 15 to 20 feet high. Its feathery white flowers come in July, after nearly all other flowering trees and shrubs have blossomed. In the autumn this tree displays perhaps the most brilliant foliage of any of our native trees or shrubs. Colors range from scarlets to the richest crimsons, sometimes with purple.

There are several native species of *Prunus* that are worth growing in gardens, but they are little seen because they have been so long overshadowed by the brilliance of the Asiatic plums and cherries. Our eastern wild plum (*Prunus americana*) is well worth a place in a large garden, and the same may be said for our native chokecherry (*Prunus virginiana*). This has handsome long drooping racemes of white flowers followed by red berries in midsummer. It is rather weedy in the East and is seen at its best in the colder parts of the Middle West.

Nearly all the trees mentioned have fruits which are attractive to birds, and many bird lovers plant them for that reason alone. These trees require no particular type of soil or treatment and they do not have any unreasonable disease or insect troubles. They give great charm and beauty to our native landscape and can bring joy to those who grow them in their gardens.

MAGNOLIA GRANDIFLORA grows in moist woods from Philadelphia southward to Louisiana. Fragrant white flowers 6 to 8 inches across and large, glossy, evergreen leaves.

McFarland

WILD-FLOWER PROPAGATION

G. C. Nearing

VIRTUALLY all plants will grow from seeds sown where conditions are similar to those found in their natural growing area. However, seeds are not always easy to harvest and some do not germinate until the second or even the third year. And few of us can arrange and care for any great number of natural situations, especially as birds, mice and chipmunks are searching day and night for many of these same seeds.

Where seed propagation fails or is difficult, or where we wish to multiply an exceptionally fine individual plant, we naturally turn to propagation by divisions or cuttings. This is particularly important with plants less than fully hardy, for once a hardier than average individual is discovered, it can be multiplied at will and every propagation from it will retain nearly the same degree of hardiness. Other qualities, such as profuse flowering, superior color, or flower size, can also be perpetuated.

Some plants propagate easily by cuttings or divisions. Others may be difficult or slow, or both. For some of the easiest, it is only necessary to stick a fragment in the open ground. In a few days it will take root and grow. Others must be given special care and, even under the most favorable conditions, may require a year or more of coddling before they are ready to plant in the open.

Propagating devices, to be practical and convenient, should provide conditions suited to the most difficult plants: easier species placed in them can be handled with no trouble at all. A simple box, partly sunk in the ground and covered with a pane of glass, can be made to root all but the most intractable cuttings provided it is placed in the correct situation. It should not, of course, be so placed that it will fill with water for long periods or dry out too rapidly.

Most important, the direct rays of the sun must not strike the glass; if they do, the air inside will heat rapidly and burn up the cuttings unless ventilation is provided. This is why greenhouses are equipped with elaborate ventilators. However, ventilation cancels one of the most important functions of the glass—the retention of humidity. For that reason, certain cuttings, notably those of rhododendrons, which are especially dependent on humidity, refused to root in greenhouses until mist machines were invented.

On the other hand, cuttings will not root in the dark, and the more light they receive, short of direct sunshine, the more quickly they root. For centuries propagators failed to solve the problem of providing light enough without letting in the sun. Sometimes the north wall of a building, if open to the sky, will provide satisfactory lighting, especially if the wall is white. But there is a way of shielding the box in an open field, which nobody thought of until about 1926. A slanted hood or baffle is placed directly south of the box, with extensions around the east and west sides. These cut off the sun's rays in the morning and afternoon, while opening wide to the north sky. All are painted white to reflect as much indirect light as possible into the box. These boxes are best placed in rows so that the reflection from the hood of the box to the north helps light the box to the south.

If only one box is used, a baffle can be placed to the north so as to reflect light into it. Any box so arranged will root a wide variety of plant material and only occasional watering will be required to keep the soil from drying out. Some use a bottomless box, but this offers the disadvantage that it is difficult to protect against flooding, drying, and especially rodents. I prefer a box with a fairly tight bottom, which, after watering, will permit the excess water to seep away very slowly. Such a box can go weeks without watering, yet give a high percentage of rooting.

Many different media can be used in

Bob Brush

Author inspects his specially built frame for propagating native plants. The slanted hood of the frame faces south to protect the cuttings from direct rays of the sun. When light shines on the white wall of the frame to the north, it furnishes illumination for the plants.

the box—sand, peat, mixtures of sand and peat, or special substitutes. My own practice is to mix a bottom layer of peat-moss three parts, spent mushroom manure one part, and just a little sulphur. Above this is a thin layer of half and half Michigan peat and sand, then about two inches of pure sand. The choice of sand is important. It should be a coarse grade of mason's sand, but containing plenty of fine grains along with the coarse. This medium has given the best results year in and year out, but others are nearly as good. Chemicals to promote root growth are to me something of an enigma, and after experimenting with them for a number of years I have stopped using them.

Although my propagating frame was intended primarily for rooting cuttings of rhododendron, it has been found useful for a wide variety of other material, including conifers, broad-leaved evergreens and deciduous shrubs, and plants such as trailing-arbutus and partridge-berry. Cuttings of evergreen plants are best taken in fall, but almost any time of year will do except when the ground is frozen or when tips are very soft. Branches of rhododendron broken by winter accidents are often thrown into the box immediately, left there until the sand thaws, then prepared and inserted in the usual way. Cuttings of other plants can often be handled similarly when necessary. Cuttings lying on the surface of the sand unnoticed have sometimes rooted there. For best results, the parent plant should be in vigorous condition and well watered at the time cuttings are taken.

Cuttings should have all leaves stripped from the base, should be wounded by side-slicing near the butt, then inserted one or two inches in the sand. Short cuttings root more quickly, but longer ones develop better after rooting. Leaves may be thinned on the upper part of the cutting, chiefly to prevent the cuttings from shading each other.

Plants with a running rootstock, such as wintergreen (*Gaultheria procumbens*), goldthread (*Coptis trifolia*), spotted wintergreen (*Chimaphila maculata*) and *Polygala paucifolia* are best handled by

cutting the rootstock into sections, each with a stem or leaf rising from it, and setting them in the sand about as deep as they were in the soil.

Trailing-arbutus (*Epigaea repens*) is actually a low-growing shrub, lending itself well to cutting propagation, as do most creeping shrubs. Bearberry (*Arctostaphylos uva-ursi*), partridge-berry (*Mitchella repens*) and broom-crowberry (*Corema conradi*) belong to this class, and all do well from cuttings.

Plants such as *Phlox divaricata*, *Tiarella cordifolia*, *Aster linariifolius*, and many others will root freely if pieces of the stem are cut in summer and placed in the sand. Nearly any perennial of this type can also be propagated by crown divisions, which can be placed directly in the open ground without using the propagating frame. But if numbers are wanted, both divisions and cuttings can be used, furnishing many more propagations from the same plant. Any species which does not ordinarily respond well to division may do better if the divisions are rooted like cuttings in the propagating frame.

The late Mrs. F. G. Dunham of Ridgewood, N. J., tried an interesting experiment, laying a stalk of the cardinal-flower (*Lobelia cardinalis*) on the surface of the sand. She reported that it soon rooted at the nodes, and could then be cut apart to form several plants. She tried also cuttings of the club mosses (*Lycopodium lucidulum*, *obscurum*, *clavatum* and *flabelliforme*). Of these only *lucidulum* did well, but it might be worth while to experiment further with them, as they all make excellent ground covers. *L. lucidulum* can be multiplied by means of its gemmae, which are borne here and there in the axils of the upper leaves and look like three or four leaves of different lengths folded together. These can easily be detached and placed on the surface of the sand in the propagating frame, where they quickly take root, each forming a new plant.

Other procedures can be devised to suit special cases. Sometimes rules of propagation are laid down, but actually there are no rules. One of the rules most often and most emphatically stated is that ample drainage must be provided. In the system described above, there is no drainage, and with drainage it will not work well, requiring daily instead of weekly watering. Plastic is often substituted for glass, in spite of its tendency to tear into shreds and blow away in the wind. It is of course easily and cheaply replaced, and if this is done in time, the cuttings will not die.

What should be kept constantly in mind, as the basis of all experiments, is that nature provides most plants with the ability to put out roots from broken parts of stems. Only under certain conditions will the roots form, and these conditions can be studied in nature in order to reproduce them for our gardening purposes.

PARTRIDGE-BERRY (*Mitchella repens*), shown about natural size. This small-leaved creeper can be propagated from cuttings.

Lynwood M. Chace from NAS

A DOZEN NATIVE SHRUBS FOR MODERN GARDENS

Gertrude S. Wister

McFarland

MOUNTAIN-LAUREL (*Kalmia latifolia*). One of the finest native evergreen shrubs. Pink to white flowers in dense clusters. Best bloom in full sun.

HOW difficult it is to choose just a dozen beautiful shrubs from the many that ornament our woodlands!

Mountain-laurel (*Kalmia latifolia*) is a truly noble plant to head the list. The handsomest member of a small genus found only in North America and Cuba, mountain-laurel grows wild from the Canadian province of New Brunswick to western Florida, west to the northern shores of Lake Erie, and south to Tennessee, Mississippi and Louisiana. It must have an acid soil, either sandy or clayey, and containing a moderate amount of organic matter. While it tolerates fairly deep shade, it blooms more prolifically in the sun. The exquisitely modeled pink buds and the lovely flowers appearing in pink to white clusters in early summer and the shining evergreen foliage make this a versatile shrub. It can be used in mixed shrub borders, preferably with its relatives and other plants which need acid soil and humus, alone as an informal hedge, or as a specimen shrub. It has a place in any kind of gardening. However, aside from a little shaping and infrequent pruning, it should be allowed to assume its natural form. The bark of older specimens is to be admired.

The plants sold by nurseries are usually collected from the wild. Avoid those with many thin stems. They are often the sprouts from very old plants that have been cut to the ground and allowed to sprout anew. The root-systems of such plants are often very poor.

Carolina rhododendron (*Rhododendron carolinianum*) is limited in its natural range to the mountains of the western Carolinas and eastern Tennessee. This rhododendron is hardy to middle New England and southern New York State. It is valuable for its evergreen leaves, about three inches long, smaller than those of other commonly grown rhododendrons, and for its extreme floriferousness. Although its usual color is a purplish rose, it ranges through the lighter pinks and lavender-pinks to white. It is possible, by growing it from seed and selecting the clearest colors, to work into pure pinks and salmon-pinks.

Carolina rhododendron will tolerate moderate shade, but light shade suits it better, and a fair amount of sun is needed to encourage an abundance of blooms. The flowers are earlier than those of the more commonly grown hybrids.

This is a shrub that can be used in mixed borders in front of its larger relatives, in foundation plantings where there is no severe glare or heat reflection from the building, or in wild and semi-wild gardens. It needs, of course, an acid and humusy soil. Good drainage seems to be a necessity.

Pinkshell azalea (*Rhododendron vaseyi*), from western North Carolina, is notable for the delicacy of its butterfly-like flowers. They are pure pink, pale pink, or pure white, and they open just before the leaves in early spring. It is a good companion for its kin—the rhododendrons, laurels and so forth—in mixed plantings where its deciduous habit and lighter foliage (which has good autumn color) lend contrast to an evergreen mass. Rather upright in habit, this plant eventually reaches a height of six to eight feet. It is hardy to Michigan and southern Maine where the soil is acid. It has many garden uses where its sometimes straggly growth is not a count against it. Although most plants sold are collected from the wild, it should be grown from seed to safeguard the wild stands, which are limited. Selection should lead to the deepest pinks, and perhaps some day a commercially profitable method will be developed by which they can be grown from cuttings.

There is a wealth of other American species, blooming from early spring late into the summer. Fragrant pink and fragrant white, gay orange, dazzling scarlet, and sunny yellow—they await better propagation methods for the multiplication of the best selections. Their deciduous habit is no doubt a strike against them in the eyes of those who are used to the evergreen easily-propagated Asiatic azaleas so popular now, but their beauty is being recognized and they should appeal to discriminating gardeners.

Summersweet or sweet pepperbush (*Clethra alnifolia*) grows along streamsides and swamps from Canada to Georgia, but is well adapted to garden use if the soil is acid and retains moisture reasonably well. The flowers come in midsummer, and open over a period of about a month. They are white, wonderfully fragrant, in slender upright racemes about three to six inches long, good for cutting. Since the flowers are borne on the new growth, the shrub can be pruned back in early spring, and there will still be bloom that summer. In woodlands the growth reaches about nine feet, but in the garden it can be kept at any desired height by selective pruning.

The summersweet can be used in mixed shrub plantings, also in large perennial borders, because its upright growth can be kept neat, and its glossy green foliage, lovely all summer, turns to gold in the fall. Its midsummer spikes of bloom provide a valuable contrast to other flower forms. Summersweet is a polite neighbor to the larger perennials, and flourishes, of course, in damp places. It is one of the last shrubs to come into leaf in the spring.

Fothergilla major, which has no common name, blooms in the early spring

McFarland

Roche

Left: SWEET PEPPERBUSH (*Clethra alnifolia*) fragrant in late summer; at right: HIGHBUSH BLUEBERRY (*Vaccinium corymbosum*), fine both in flower and fruit.

when its coarsely-toothed leaves, bronzy at first, are unfolding. The bloom spikes, about three inches long, set closely with white flowers, look a little like stubby bottle-brushes. The autumn color of the foliage is splendid.

Fothergilla is circumspect of habit, rather upright, and it reaches a height of nine feet eventually if not headed back. It has two smaller but similar relatives, *F. gardeni,* earlier to bloom, reaching about three feet, and *F. monticola,* second to bloom, which grows about six feet tall. All are hardy into Massachusetts and Ohio, though they are natives of the southeastern states.

Highbush blueberry (*Vaccinium corymbosum*) is the species now cultivated in many varieties for its delicious fruit. The wild plants are choice ornamentals, but the birds often get the fruits before they have a chance to turn blue. Its winter aspect, with red twigs and branches set with conspicuous winter buds, is very attractive, and makes a pleasing contrast when seen against the evergreen foliage of other plants. The unfolding spring foliage is pinkish or bronzy, the fall foliage blazing red. The flowers are waxy white urns, not showy at a distance, but charming close at hand.

Although the highbush blueberry can be used in mixed borders of shrubs requiring an acid soil, sunny or partly shady, its picturesque habit makes the shrub a worthy candidate for areas where it can be shown off to advantage during the winter. It grows wild from Nova Scotia to Minnesota, and south to Florida and Louisiana, proving that it can be used over a large area where soils are acid. Usually a six-foot shrub, it sometimes reaches a height of fifteen feet.

Carolina allspice, sweetshrub, strawberry shrub, or just plain "shrub" (*Calycanthus floridus*), has been beloved since the first settlers brought it into their gardens from its woodland home, and apparently it was one of the first of our wildlings to win itself a place inside the picket fence. It carries associations of old-fashioned farmhouses, well sweeps and homey coziness. It was the fragrance of its red-brown flowers that won it this

place. Unfortunately, people who now try to buy the shrub for this fragrance often find themselves with scentless plants, either the similar species, *C. fertilis,* or just individuals with little or no odor. When it comes to selecting a plant, let your nose be your guide. Perhaps you can beg a sucker from a fortunate friend. Even among fragrant forms, the flowers of some are larger and more attractive than others.

The strawberry shrub reaches a height and spread of about six feet. Its broad glossy foliage clothes it right to the ground, so that it can be used as a specimen to good advantage, and then the modestly-colored flowers can be seen and smelled easily. Children like to carry a bloom or two in their pockets.

The strawberry shrub is a native of the southeastern states, but hardy to southern Maine and Iowa. An average good soil suits it, and it does well in partial shade. It has a California counterpart, also fragrant, but less hardy.

Withe-rod (*Viburnum cassinoides*), a tall, sturdy shrub reaching six to eight feet, grows from Newfoundland west to Manitoba, and south to North Carolina, a good demonstration of its hardiness. While it is useful as a large, tough shrub with good autumn color wherever it can be grown, it is in the North that it develops its full beauty. The large flattened clusters of tiny creamy flowers cover the bush in early summer. The fruit, as it ripens, turns first greenish-white, then pink and finally blue-black, all stages appearing in a cluster at the same time, to give a most attractive appearance.

Even hardier is the sheepberry (*V. lentago*), sometimes almost a small tree. It is a little coarser in appearance, a little less attractive in flower and fruit. Finer in texture, also taller, perhaps a little less hardy is the black-haw, *V. prunifolium.* The crimson of its unfolding spring leaves foretells its autumn glow. Its densely twiggy winter aspect also is attractive. In bloom and in fruit it is beautiful. Year-round it is suited to use as a specimen.

All these viburnums are well adapted to larger shrub borders and semi-wild gardens.

Buffaloberry (*Shepherdia argentea*) grows from Manitoba to Minnesota, and south to Kansas, Colorado and New Mexico. It is a sturdy shrub, sometimes almost a small tree, which defies heat, cold, drought, and wind. Its small flowers cover it in early spring with a greenish-yellow haze, and throughout the summer its leaves, silvery on both sides, contrast pleasantly with the foliage of other plants. In August the thickly clustered

BLACK-HAW (*Viburnum prunifolium*) is handsome at all seasons; leaves are colorful both spring and fall. ***Roche***

fruits color up—usually red, but sometimes yellow—and these too are stippled with silver. The plants are of separate sexes, so it is important to have both to insure fruit. The fruit is useful for jellies and preserves.

Buffaloberry also makes effective windbreaks and hedges. It is certainly ornamental enough to be grown as specimens or in mixed shrub borders. In milder climates, however, it is less handsome than in its rigorous home country.

Yaupon (*Ilex vomitoria*) is a splendid holly with small leaves (to one and a half inches long) and red fruit that clings all winter. Although usually seen as a shrub, it sometimes attains a height of about 25 feet, twiggy and picturesque. The yaupon is a native of the southeastern states and is not hardy much beyond its natural range from Virginia to Florida and Texas. It withstands shearing well, so is a good hedge plant. It also makes a fine specimen, in sun or partial shade. The pale gray bark adds to its effectiveness.

Fringe-tree or old-man's-beard (*Chionanthus virginicus*) is another favorite. Is it a shrub or is it a tree? It is usually seen as a large shrub with one or two trunks, but it sometimes achieves a tree-like stature of 35 feet and an eight-inch trunk. It grows from southern New Jersey to Missouri and Oklahoma, and south to Texas and Florida, but it is hardy northward to New England and southern Iowa.

The fringe-tree is late to leaf out in the spring, and when the leaves are partly grown the drooping clusters of delicate white slightly scented flowers appear, covering the shrub. Staminate plants have larger flowers and flower clusters, but the pistillate plants have the added attraction of clusters of dark blue fruit in autumn. The foliage turns yellow. For the best effect, both sexes should be planted, of course.

Fringe-tree used to be planted rather stiffly as a lawn specimen. It is seldom planted this way any more; in fact, the greater use of evergreens has sent it into obscurity. This is a pity, for it could be put to effective use if placed well in relation to nearby buildings. It can also be used as a high accent in mixed shrub borders, or to provide shade for low azaleas, or along the edges of woodlands.

Oregon grape-holly (*Mahonia aquifolium*) is not related to either grapes or hollies, though it suggests the first with its clusters of bloomy dark blue fruits, and the second with its spined evergreen leaves. But its close kinship with the barberries can be easily seen by examining the handsome clusters of bright yellow barberrylike flowers which appear in early spring. The grape-holly makes a fine evergreen mass about three feet high, or sometimes a little taller. The glossy leaves make these plants most attractive. New growth is bronze-tinted, and all of the foliage turns red or bronze color in winter, contrasting pleasingly with other evergreens.

This is a good plant to use in foundation plantings (away from too bright sun) or wherever a medium-sized evergreen shrub is needed. A native of the Pacific Northwest, it prefers areas not too cold in winter, and not too hot in summer. Southern New England and New York State are about its northern limit.

Although these shrubs and many more are being grown in our gardens—some being nursery grown, others collected—we have made only a start in the use of our native plants. All should be nursery grown, not taken from the wild. However, the finest representatives of each species should be sought and used for propagation. There is great variation in many of the species, and we get rumors every now and then of handsome variations not yet in commerce. Better forms may also be secured by growing many plants from seed, then selecting the best as the source of seed for yet more seedlings. Since undertakings of this kind are unprofitable for nurserymen, here is a rich field for exploration and adventure by amateurs.

THE NEW JERSEY PINE BARRENS

A unique environment for both rare and familiar plants

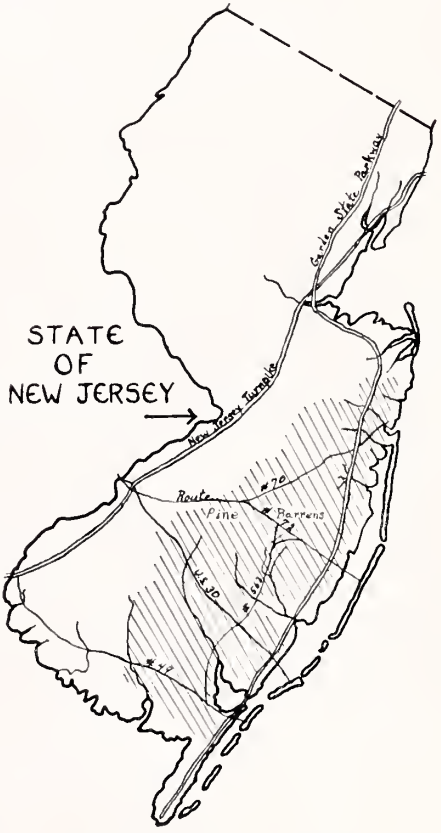
John A. Small

THE Pine Barrens of New Jersey have been of botanical interest since earliest colonial times. They were studied by some of the first botanists to visit our shores and by the resident botanists of Philadelphia.

These scientists were most conscious of the pines to be found there—pitch pine (*Pinus rigida*), shortleaf pine (*P. echinata*), and scrub pine (*P. virginiana*). These can be readily grown elsewhere by anyone who does not consider the white pine to be the only one worthy of planting. The variety of oaks was perhaps even more fascinating. Two of these, the scrub oak (*Quercus ilicifolia*) and scrub chestnut oak (*Q. prinoides*) are essentially shrubs. Blackjack oak (*Q. marilandica*) develops a symmetrical and beautifully shaped tree up to 25 or more feet tall. Post oak (*Q. stellata*) attains greater stature. Several other species are to be found but they are less restricted to the area and hence less characteristic of it.

While the American holly (*Ilex opaca*) is found in southern New Jersey, it is not usual in the Pine Barrens. Another species of *Ilex*, the inkberry (*I. glabra*) is a more typical shrub of the area. It is frequently associated with sheep-laurel (*Kalmia angustifolia*), which ranges far beyond our limits. Much more restricted than either of the foregoing, even within the area itself, is the sand-myrtle (*Leiophyllum buxifolium*) which selects moist but rather open sand for its habitat. An early bloomer, it is a welcome sight around the first of May.

Ericaceous shrubs predominate, ranging from blueberries (*Vaccinium*) and huckleberries (*Gaylussacia*) in the driest and hottest areas to other blueberries, staggerbush (*Lyonia mariana*) with the huge flowers, fetterbush (*Leucothoë racemosa*), leather-leaf (*Chamaedaphne calyculata*), dangleberry (*Gaylussacia frondosa*), and cranberry (*Vaccinium macrocar-*



The Pine Barrens (shown by diagonal lines on the map of New Jersey above) occupy the outer part of the Coastal Plains Province and comprise one-fourth of the total area of the state. Parts of eight counties lie within its 2,000 square miles. For about 75 miles the Garden State Parkway crosses the area, running north and south. Picnic areas and exits give the traveler a chance to observe details of the unusual scene. From Camden, N. J., the Pine Barrens can be reached via route 70 or U. S. 30. From the Delaware Memorial Bridge, route 49 or U. S. 40 will take one there. The region contains, besides a wilderness of remarkable vegetation, five state forests, a state park, extensive public hunting and fishing lands, and the Wharton Tract (a nature preserve) of 100,000 acres.

McFarland

SAND-MYRTLE (*Leiophyllum buxifolium*), a characteristic small evergreen shrub of damp sandy spots in the Pine Barrens, flowers in May. Takes kindly to cultivation in light soils.

pon) of increasingly wet situations. Those people acquainted with mountain-laurel (*Kalmia latifolia*), bearberry (*Arctostaphylos uva-ursi*), and trailing-arbutus (*Epigaea repens*) elsewhere are usually surprised to find them, and in such abundance, in the pine area.

Trees of the swamps and stream banks may not be too well adapted to the ordinary houselot. That is why it is such pleasure to go to the pine area to see them; that and the extraordinary effect of great massing over acres of terrain. The red maple (*Acer rubrum* var. *trilobum*), often dominating deciduous swamps of the area, is an extreme variant, a variety, or to some a distinct species. The leaves are much smaller than those of the more widely distributed red maple of the East. They are three-lobed, instead of five-lobed, pubescent to tomentose below instead of smooth.

The swamps of southern white cedar (*Chamaecyparis thyoides*) extending for miles along the always sluggish streams are even more impressive than the red maple swamps, but hardly reproducible in landscaping, though individual trees may be so grown. It is in such swamps that we may find the sweet-bay (*Magnolia virginiana*), here close to its northern limit of distribution. This tree will grow almost anywhere and, being a late-blooming species, it can be used to ex-

tend the magnolia season beyond that of the cultivated species from farther south. Like the others, it is best in its native habitat, and along a sand road through such a swamp, where one is forced to slow down, the fragrance of these flowers in June is another of the treats of the Pine Barrens. Its fragrance is followed closely in season by that of the swamp "honeysuckle," or clammy azalea (*Rhododendron viscosum*) in the same habitat.

Another plant of shores and wet banks renowned for its somewhat similar fragrance but appearing later is the shrub sweet pepperbush (*Clethra alnifolia*). This is a massive shrub that blooms in August. In June the swamps and stream banks reveal occasional stands of the white-flowered Virginia-willow (*Itea virginica*), which can be cultivated even in drier areas much farther north. Perhaps it is well to point out that habitats such as these also support poison sumach (*Rhus vernix*).

Two other small but remarkable shrubs, or semi-shrubs, should be mentioned. They are strict natives and their demands are so exacting that attempting to remove them to a garden is futile. The pixie-moss (*Pyxidanthera barbulata*) is the earlier flowering (April). It is no moss, but is a prostrate shrub, with flowers that almost sparkle on the sand. The leaves are sometimes pigmented, reddish as well as green. The other shrub is Pine Barrens heather (*Hudsonia ericoides*). Erect, it is conspicuous all year but in its brief flowering period, about June 1, it is most generous; patches of the plant become masses of golden bloom. It must be realized, however, that these sights are rewards for visiting the Pine Barrens. Transplanting will fail. Let them live.

The two preceding species, plus bearberry, trailing arbutus, and mountain-laurel may be found in greatest abundance on the part of the Pine Barrens known as the Plains. Route 72 passes through it eastward after underpassing the Central Railroad of New Jersey. Here the oaks and pines are dwarfed. Attempting to explain this condition has intrigued investigators from the earliest days and resulted in an assortment of theories.

The herbaceous plants of the barrens are likewise a fascinating group. Some of the seemingly driest areas have open white sand with trees too far apart to form a closed canopy. In such places one may find the attractive Pine Barrens chickweed or sandwort (*Arenaria caroliniana*). It has a long flowering period and is more erect than other chickweeds. Later in the season another plant of dry ground, but of much wider distribution appears. This is jointweed (*Polygonella articulata*). Both have small white flowers. Three noteworthy members of the Pea family are found along the roadways. Wild indigo (*Baptisia tinctoria*) has yellow flowers, lupine (*Lupinus perennis*), blue to purplish, and goat's-rue (*Tephrosia virginiana*), yellow flowers with an admixture of red. The wide distribution of these plants may suggest a less demanding nature as to habitat. Growing them from seed should be more successful than transplanting. Most plants of the Pine Barrens have extensive root systems either in breadth or depth. The sand is so loose that lifting such a system for transplanting without injury or disturbance is indeed a problem. For example, Pine Barrens spurge, or wild ipecac (*Euphorbia ipecacuanhae*) has a taproot extending straight down far beyond the limits practical for transplanting.

There are several asters common to the dry areas. The golden-aster (*Chrysopsis mariana*) is also common and frequently associated with the blazing-star (*Liatris graminifolia*). The boneset (*Eupatorium*) are also well represented. With these plants we must move into more moist surroundings. Of particular interest then will be the slender goldenrod (*Solidago stricta*), the orange milkwort (*Polygala lutea*), and the Pine Barrens gentian (*Gentiana autumnalis* var. *porphyrio*). The latter plant has been sought so vigorously by thoughtless and/or vicious, would-be wild-flower growers for their selfish interests, that where fifty years ago it was considered common it is now

a real rarity urgently in need of all possible preservation. There appears to be no record of successful use in a garden.

The turkey-beard (*Xerophyllum asphodeloides*) is another plant of moist situations, flowering in June with a dense raceme of white terminating a three-foot stalk arising among grass-like leaves. These moist habitats range all the way to bogs, swamps and stream banks. Some plants are widely tolerant, others very narrowly so, as witness the bog-asphodel (*Narthecium americanum*), which may be profuse on one bog but completely absent from an apparently similar one. So it is futile to attempt transplanting, but it is well worth a trip to see a good stand in late June.

There will be rose pogonia (*Pogonia ophioglossoides*) and grass-pink (*Calopogon pulchellus*), two beautiful orchids associated with the *Narthecium,* besides the pitcher-plant (*Sarracenia purpurea*) and the early flowers on thread-leaved sundew (*Drosera filiformis*). By all means go back a month later when golden-crest (*Lophiola americana*) and red-root (*Lachnanthes tinctoria*) will be blooming with the other sundews and the bladderworts (*Utricularia*) and orchids. These plants should never be considered as horticultural material but rather as exquisite detail in that remarkable wild-flower garden, the New Jersey Pine Barrens.

Within the streams, which make excellent canoeing, downstream recommended, one may also follow the seasons beginning in April when golden-club (*Orontium aquaticum*) may be expected, followed by spatter-dock (*Nuphar advena*) and water-lily (*Nymphaea odorata*). In shallow water and on muddy banks look for pipeworts (*Eriocaulon*) and yellow-eyed grass (*Xyris*), while on sand or gravel bars these may be replaced by deergrass (*Rhexia*).

Back among the bogs, if you have perceptive eyes, you may find the diminutive curly-grass fern (*Schizaea pusilla*), which grows in no other spot in the United States. An area that contains so much unique vegetation, the only region of its kind on the American continent, should long ago have been made a national natural history preserve.

TRAILING-ARBUTUS (*Epigaea repens*) is abundant in the Pine Barrens and a favorite in wild gardens in the Northeast. *Roche*

WILD PLANTS IN THE TERRARIUM

Emilie K. Hammond

A TERRARIUM is a garden of small plants enclosed in a glass container. While primarily for miniature indoor culture of a piece of outdoor woodland, a terrarium may be used for propagation.

For the person who makes a terrarium, there is the joy of gathering the wild material, and reassembling it to his and Nature's satisfaction, also the pleasure of seeing it grow during the winter months.

The first terrarium was invented in 1836 by N. B. Ward to transport living plants across the ocean. This nearly-airtight Wardian case with glass top and sides assured at least some control of light, temperature, and humidity, and allowed a minimum of care. Similar cases are still used for growing as well as transporting living plants. Ferns and leafy plant cuttings requiring a high humidity and moist soil conditions can be raised to the potting stage in a terrarium. Usually, a rectangular aquarium-type container is used for propagation and transportation purposes; but in making an ornamental terrarium, any shape of clear thin glass container may be used if the lid fits tightly. It may be a globe, an oval, or a cylinder, an antique glass lantern, brandy snifter, bell glass—or even a candy jar. However, the container should be large enough to provide working space within and to show the individual plants to best advantage. A 10- to 12-inch diameter container is preferable to anything smaller.

The next step in making a terrarium is to decide what you wish to depict in it: a woodland scene, a miniature bog with a tiny pool, a rocky ledge as a setting for tiny ferns, or a ravine with a woodland path running through it. You may find it convenient to draw a picture of the design, using lycopods and ferns as trees, small rocks as boulders, and small flowering plants as ground covers. Lakes and pools may be made with mirror glass, shells, or of small china dishes filled with water. Paths may be constructed of fine white limestone, small flat stones, or simply suggested by tamping down the soil.

Now you are ready to gather the plants and other essential materials for your terrarium. Rocks, pebbles and charcoal are available any time. Lichens and mosses are best when picked dry in early autumn. They should be kept cool and dry in a shady spot until used. All plant material should be collected after the first frost. As soon as the plants are brought in, they should be individually washed in cold water so that no soil is left on the roots. They can then be safely stored by placing them in fresh sphagnum moss in an air-tight metal container or plastic bag and kept at a temperature of 60 degrees or less. Woods soil should be dug dry and put through a fine sieve before using. A mixture of ⅓ sand (builder's sand, not sea sand) to ⅔ sifted woods soil is ideal for wild plants.

Lastly, there are certain tools to aid in making a terrarium—a tablespoon, a long-handled teaspoon, a pair of scissors, a small watering can, and a tamper stick. The latter may be made of a 10-inch length of aluminum wire with both ends hammered flat, one end bent to a 45-degree angle and any rough edges filed off. The tamper is the perfect tool for pushing roots gently into the soil, pressing edges of moss into place, and indicating and constructing path or steps. Two receptacles filled with clean cold water should be ready on the work table along with some absorbent paper or clean lint-free cloth.

With the design in mind, and materials and tools at hand, the construction of the terrarium may begin. Here is the procedure I use for making a terrarium of wild plant material: First, container is lined with clean fern moss (*Thuidium*) with green side next to glass. There should be about an inch of lining in front, the sides and back according to preferred design. For example, in making a "hillside," the moss would be an inch high in front, then slanting upward along the sides to within two inches of the top of the container. If the designer has a ravine in mind, the back lining may be irregular, sloping down toward the back center of the container and then up.

The next step is to cover the container bottom with ½ inch of small (¼ inch) limestone or pebbles and charcoal. This insures good drainage and helps to keep the soil sweet. Now spoon-in the soil mixture with the large tablespoon. Again, the amount of soil depends on the design, but it should always come to within ¼ inch of the top of the lining moss, which may now be tamped down around the edges for neatness and to keep the soil from shifting. Paths or pools may be indicated at this point by tamping down the soil in the desired area. Now water lightly, being careful not to muddy edges next to the glass. Rocks may be put in next if they are center ledges; but tall rocks should be left until later, as it is difficult to plant behind them.

The final step before planting is to edge the terrarium with moss. Only a few are satisfactory. The following hold up well: Fern moss (*Thuidium*), used for lining the terrarium, is found on rocks and logs in cool damp woodlands. Small pieces may be used on soil as edging in the foreground. Pincushion (*Leucobryum*) is found under oaks and hemlocks on rocky hillsides, and is the best moss for edging. *Dicranum* and *Grimmia*, both found on rocks in cool woods, are also satisfactory. Other species of moss tend to turn brown quickly or mold. To plant these mosses in the terrarium, moisten clean pieces of each of them and press onto outer edges of soil.

Now the terrarium is ready to receive ferns and other plants. Almost any wild evergreen plant may be used; but some survive longer than others. The design should be carefully followed, using hillside plants on slopes and bog plants in the low foreground. In a container of 16 inches or more in diameter, a combination of hillside and bog might be satisfactorily planted; but generally they would be done in separate containers. Now to plant the hillside as an example: Tall evergreen species such as groundpine (*Lycopodium obscurum*), shining club-moss (*Lycopodium lucidulum*) spotted wintergreen (*Chimaphila maculata*), pipsissewa (*C. umbellata*), and hepatica (collected with a large flower bud), are used in the background and should be planted first. Low evergreen plants are used in the foreground. Partridge-berry (*Mitchella repens*) shows to best advantage if planted between the mosses with the berry close to the glass. Each piece should have at least one root. This is tamped gently but firmly into the soil between the mosses at the outer edge of the container. Other low woodland plants suitable for the hillside design are rattlesnake-plantains (*Goodyera repens* and *G. tesselata*), goldthread (*Coptis trifolia*), trailing-arbutus (*Epigaca repens*), and *Corydalis sempervirens*. For height in the bog design, *Lycopodium obscurum* and *L. lucidulum* may be used with the sundews (*Drosera*), small pitcher-plants (*Sarracenia*), Venus flytrap (*Dionaca muscipula*) and sphagnum moss in the foreground.

The center of the terrarium is a focal point and should be done very carefully. Rocks, preferably light in color, are excellent for heights and ledges. After washing them thoroughly, push them down deep into the soil, being careful to avoid plant roots. Tall pointy rocks are good for height and thin colored rocks make interesting ledges. Never use wood, bark, or fungus material as it will mold.

Close to the rocks and between the ledges evergreen ferns do well and give a natural effect. If limestone rocks are used, the following may be planted: walk-

Kuche

TERRARIUM, arrangement by the author. The naturalistic miniature woodland scene includes partridge-berry, rattlesnake-plantain (center front), several kinds of lycopodium, walking fern (on the stone), pipsissewa, hepatica and ebony spleenwort, with mosses and lichens.

ing fern (*Camptosorus rhizophyllus*), maidenhair spleenwort (*Asplenium trichomanes*), wall-rue (*Asplenium cryptolepis*), and purple cliff-brake (*Pellaea atropurpurea*). Polypody (*Polypodium virginianum*), ebony spleenwort (*Asplenium platyneuron*), and grape ferns (*Botrychium obliquum* and *B. dissectum*) may be planted with any type of rock. Tree moss (*Climacium americanum*), rose bryum (*Rhodobryum roseum*), and small entire plants or cuttings of ground-cedar (*Lycopodium complanatum* var. *tristachyum*) may be used to fill in between ferns and along the path. If there are still any empty spots to be covered, lichens are colorful and will live for several months. Best to use are pink earth lichen, "British Soldiers," slender ladder lichen, goblet lichen, and reindeer-moss.

Stones for a path are added after the plant material. The long-handled spoon is used to put them into the already marked pathway. When the stones are in place, the path should be lightly watered and the stones tamped down into the soil. Discarded wood-snail shells, if carefully cleaned, are an added attraction.

The final step in constructing a terrarium is to clean the glass of the container both inside and out with a damp paper or lint-free cloth. When the container walls are free of moisture, tape down the lid to keep all the moisture inside. Unless the garden looks extremely dry, do not remove the lid to add water. Or at most, add it only sparingly. For best results, keep the terrarium in a cool spot with a northern exposure where sun never shines directly on it.

All of the plants listed above are evergreen and as such they freeze and thaw out in their natural habitat. It has been my experience that a terrarium may be stored out of doors in freezing weather, if desired, and then when brought into a 70-degree temperature, the plants will thaw out just as they do in spring.

BROOKLYN'S OWN NATIVE-PLANT GARDEN

WOODLAND walks such as seldom exist within a city's boundaries are one of the attractions of the garden of native plants at the Brooklyn Botanic Garden. Here beneath leafless branches one can see the earliest flowers. After summer's bloom, as autumn enflames foliage, the yellows and purples of the season's dominant flowers color their part of the scene. When fallen leaves carpet the ground and dark branches are patterned against the sky, the paths of this city wild garden are no less a pleasant place to stroll.

Before entering the woodland one can see several other realistically created plantings. A sand barren and a bog have been devised with sand and peat from New Jersey's Pine Barrens. Hudsonia, broom-crowberry, and bearberry are among the characteristic plants inhabiting the sand barren. In the bog grow white-

Photos by Gottscho-Schleisner

cedar trees, rhodora, calla, and other plants seldom seen except in the wild.

A pond, representing a kettle-hole in the glaciated section of Long Island, contains golden-club, pickerel-weed, and other showy aquatics. On its shore a thicket shelters rose-purple rhexia.

Heath plants grow together in an area of dry, acid soil: mountain-laurel, sheep-laurel, azalea, trailing-arbutus, and blueberry. In contrast, a limestone wall supports walking fern, cliff-brakes and wall-rue, among lime-loving wild flowers.

From Staten Island some serpentine rocks were transported to form an appropriate setting for plants of a serpentine barren. Here may be seen the shooting-star and the wild form of *Phlox subulata*.

On Long Island there was once a 16,000-acre plain. A portion of this has been simulated with the help of turf from the small remaining portion of this area.

A small brook, along which skunk-cabbage and Jack-in-the-pulpit grow naturally, feeds a meadow where marsh-marigolds abound.

All of the wild garden's several hundred species of plants (except for invaders) can be found growing naturally within 100 miles of the Brooklyn Botanic Garden. They show what the landscape once was like, and also which among the native plants can be made to grow, given conditions corresponding to those of their natural habitat.

NATIVE-PLANT GROUND COVERS

Daniel J. Foley

	NORTH*		SOUTH*		WEST	
	SHADE	SUN	SHADE	SUN	SHADE	SUN
Allegheny-spurge—*Pachysandra procumbens*	x		x			
Baccharis—*see* Dwarf baccharis						
Barren-strawberry—*Waldsteinia fragarioides*	x	x	x			
Barrenwort—*Vancouveria hexandra*	x					
Bayberry—*Myrica pensylvanica*		x				
Beach wormwood—*Artemisia stelleriana*		x		x		
Bearberry—*Arctostaphylos uva-ursi*		x		x		x
Bellwort—*Uvularia grandiflora*	x					
Bittersweet—*Celastrus scandens*		x		x		
Bleeding-heart, Pacific—*Dicentra formosa*					x	x
See also Fringed bleeding-heart						
Bloodroot—*Sanguinaria canadensis*	x					
Bluebell, Virginia—*Mertensia virginica*	x					
Blueberry—*see* Lowbush blueberry						
Bog-rosemary—*Andromeda polifolia*	x					
Box huckleberry—*Gaylussacia brachycera*	x		x			
Bunchberry—*Cornus canadensis*	x				x	
Buttercup—*see* Creeping buttercup						
California-fuchsia—*Zauschneria californica*						x
Z. latifolia var. *etteri*						x
Carmel creeper—*Ceanothus griseus* var. *horizontalis*					x	x
Cinquefoil—*Potentilla* species		x		x		
Clintonia—*Clintonia borealis*	x					
Coralberry—*Symphoricarpos orbiculatus*	x	x	x	x		
Cowberry—*Vaccinium vitis-idaea*	x	x	x	x		
See also Mountain cranberry						
Creeping barberry—*Mahonia* (*Berberis*) *repens*	x		x		x	
Creeping buttercup—*Ranunculus repens*					x	
Creeping snowberry—*Chiogenes hispidula*	x		x		x	x
Crested iris—*Iris cristata*		x				
Dichondra—*Dichondra repens* (*D. carolinensis*)			x	x	x	x
Dutchman's-breeches—*Dicentra cucullaria*	x					
Dwarf baccharis—*Baccharis pilularis*					x	x
Dwarf willow—*Salix* species		x				
Ferns—Many kinds	x	x	x		x	x
False Solomon's-seal—*Smilacina racemosa*	x					
Foam-flower—*Tiarella cordifolia*	x					
Fragrant sumac—*Rhus aromatica*	x	x				
Fringed bleeding-heart—*Dicentra eximia*	x		x		x	
Galax—*Galax aphylla*	x		x			
Goldthread—*Coptis trifolia*	x		x			
Ground-hemlock—*Taxus canadensis* var. *stricta*	x					
Harebell—*Campanula rotundifolia*	x	x				
Jacob's-ladder—*Polemonium reptans*	x	x	x			
Juniper—*Juniperus horizontalis* and varieties		x		x		x
J. communis var. *depressa*		x				
J. c. var. *saxatilis*						x
Laurel Hill manzanita—*Arctostaphylos franciscana*						x
Leucothoë—*Leucothoë editorum* (*L. catesbaei*)	x		x			
Longleaf mahonia—*Mahonia nervosa*					x	

	NORTH*		SOUTH*		WEST	
	SHADE	SUN	SHADE	SUN	SHADE	SUN
Lowbush blueberry—*Vaccinium angustifolium*	x	x	x	x		
Mayapple—*Podophyllum peltatum*	x		x			
Mayflower, Canada—*Maianthemum canadense*	x		x			
Moss sandwort—*Arenaria verna* var. *caespitosa*	x	x			x	x
Mountain andromeda—*Pieris floribunda*	x	x	x	x		
Mountain cranberry—*Vaccinium vitis-idaea* var. *minus*		x			x	x
Oconee-bells—*Shortia galacifolia*	x		x		x	
Oregon holly-grape—*Mahonia aquifolium*	x		x			
Pachistima—*Pachistima canbyi*	x	x	x	x		
Partridge-berry—*Mitchella repens*	x		x			
Phlox, blue—*Phlox divaricata*	x	x	x	x		
Camla—*P. camlaensis*	x	x	x	x		
creeping—*P. stolonifera*	x	x	x	x		
moss-pink—*P. subulata*	x	x	x	x		
mountain—*P. ovata*	x	x	x	x		
trailing—*P. nivalis* and *P. procumbens*	x	x	x	x		
Pipsissewa—*Chimaphila umbellata*	x					
Pussytoes—*Antennaria rosea*		x				
Point Reyes ceanothus—*Ceanothus gloriosus*					x	x
St.-John's-wort—*Hypericum* species	x	x	x	x		
Salal—*Gaultheria shallon*						x
Sand-myrtle—*Leiophyllum buxifolium* var. *prostratum*	x	x	x	x		
Sandwort—*Arenaria* species	x		x			
Sheep-laurel—*Kalmia angustifolia*		x				
Solomon's-seal—*Polygonatum biflorum*	x		x			
Strawberry, American—*Fragaria vesca* var. *americana*	x	x	x	x		
Virginia—*F. virginiana*	x	x	x	x		
wild—*F. chiloensis*					x	x
Sumac—*see* Fragrant sumac						
Sweet-fern—*Comptonia peregrina*		x				
Tick-trefoil—*Desmodium canescens*				x		
Trailing-arbutus—*Epigaea repens*	x		x			
Trillium—*Trillium* species	x		x			
Twinflower—*Linnaea borealis*	x		x		x	
Violets—*Viola* species	x	x	x		x	x
Virgin's-bower—*Clematis virginiana*	x	x	x	x		
Virginia creeper—*Parthenocissus quinquefolia*	x	x	x	x		
Wild geranium—*Geranium maculatum*	x					
Wild ginger—*Asarum* species	x		x			
Wintergreen—*Gaultheria procumbens*	x		x			
Oregon—*G. ovalifolia*					x	x
western—*G. humifusa*					x	x
Woolly yarrow—*Achillea tomentosa*		x		x	x	x
Yerba buena—*Micromeria chamissonis*					x	x

*Comprising eastern and midwestern regions and, to some extent, regions farther west.

PHLOX ALYSSIFOLIA. Many kinds of phlox make good ground covers.
Claude A. Barr

THE SEEDS OF WILD FLOWERS

How to collect and start them into growth

P. L. Ricker

THERE is a bounty of Nature for all to enjoy, free, colorful, rewarding, that wants only protection against destruction. It is the bounty of wild plants. Probably about 20 thousand species of trees, shrubs, and herbaceous plants in the United State are classified as wild. About 15 per cent are well-established species that came from other countries or escaped from cultivation. Most of them are herbaceous. A goodly number have leaves and flowers so attractive that many persons want to grow them in home gardens, along roadsides, and in other suitable places, large and small.

Some natural difficulties, which pertain also to cultivated plants and involve the age-long adaptation to a particular soil, the amount of moisture, sunlight and heat are encountered when one tries to domesticate the wildlings, but growing them is worth the effort. The few dealers in seeds of wild flowers carry a large number of species and their catalogs usually give directions for cultivation. A list of dealers may be obtained from the U.S. National Arboretum, Washington 25, D. C.

Collecting

Wild-flower enthusiasts will get pleasure from collecting their own seed. Many

National Geographic Society

P. L. Ricker, veteran campaigner for the preservation of our native wild flowers, photographing Virginia-bluebells in Rock Creek Park, Washington, D. C.

beautiful non-weedy species may be found along roadsides, and particularly secondary roads, and adjoining fields near pastures and wooded areas. Most seeds can be collected within a month after the flowering period. Each kind, with stem and often basal leaves to help identify the species, should be placed in an envelope or transparent bag of an appropriate size, with notation of the name, the date and place of collecting; the type of soil, whether dry, moist, or wet; details of the surroundings, whether open or dense woods and the predominant type of tree growth.

Seed capsules and pods can be stripped from the stems and the seed crushed out by hand or by light pounding in the bag in which they were collected. The seed will fall to the bottom of the bag and most of the coarse material can be removed. One who collects seeds should not overlook those with fleshy coverings. To advance germination, the covering can be removed by soaking the seed in warm water overnight, or until the coating softens. Then the seeds are placed in a sieve with a mesh smaller than the seeds. The coating is scrubbed off with a stiff-bristled or wire brush.

Keeping a collection of samples of all seeds of wild flowers one obtains is an interesting hobby. Small seeds are best kept in straight-walled glass vials ⅜ by 1¾ inches in size with cork stoppers. The vials should be labeled with the botanical name, the date and place of collecting and reference to a photograph or pressed specimen.

Most wild seeds ripen and fall to the ground about a month after flowering. Those that are light or have wings or hairy appendages are blown some distance by the wind before falling.

A few species, particularly of annuals or biennials, like the daisy-fleabane and fringed gentian, may germinate almost at once and develop leaf rosettes in the same fall, but seeds of most wild flowers in temperate regions require one winter in the ground before germinating. Without the right conditions of moisture and temperature to germinate the following spring, they may remain dormant until conditions are right—maybe another year or two. We can sometime break the dormancy and advance germination by refrigerating the seeds for a period before planting.

Growing From Seed

If seeds are broadcast along roadsides or in woodlands that are covered with more aggressive vegetation, the seedling plants may be choked out. Much better results will be obtained if the ground is cleared and a good seedbed is prepared. Along some roadsides in Texas, the State highway department has obtained good results by mowing areas of attractive flowers just before the seed is fully ripe and spreading this material along roadsides not too thickly covered with other vegetation.

For home gardens it is best to sow the seed of wild flowers in the fall in flats about 3 inches deep, placed in glass- and lath-covered cold frames and transplanted in the spring when they are about 3 or 4 inches tall. Some wild flowers are difficult to establish if the roots are disturbed in transplanting. The seeds of such species should be planted in small paper or peat pots, and when ready for transplanting, pot and all should be placed in the ground where the plant is to stay.

Some wild flowers have a marked preference for soils: loamy or sandy, dry to damp or wet, acid to alkaline, and open to dense woodland conditions. Inexpensive soil-testing sets are available that give a list of soil preferences for 500 species of plants. You can tell the soil preference from the plants growing there. Areas of pine, fir, spruce, hemlock, rhododendron, mountain laurel, and oak vary from slightly to strongly acid, depending on the decomposed leaves. Seeds of most wild flowers of the six geographic areas given on the next two pages grow well in the average conditions of soil, light, and moisture of each area and habitat of each species, unless otherwise noted.

Some Notes on Growing Wild Flowers from Seed

Northeastern Species

Meadow anemone (*Anemone canadensis*). The plants prefer damp thickets or meadows; in gardens they should have partial shade.

Wild columbine (*Aquilegia canadensis*). Found in wooded or open rocky areas; plants will do well in partly shaded gardens.

Butterfly-weed (*Asclepias tuberosa*). Best raised from seed. The plants eventually develop a large, spindle-shaped root 2 to 3 feet deep in the ground.

Marsh-marigold (*Caltha palustris*). A native of wet meadows, open woods and swamps; in gardens must have similar conditions. Seeds should be planted a quarter of an inch deep in the wet margin of a pond, or in a pot that can be kept constantly wet until ready for transplanting.

Bunchberry (*Cornus canadensis*). A plant of acid soil in cool mountain woods that cannot be grown easily in gardens away from such areas unless given a cool root run.

Pink lady's-slipper (*Cypripedium acaule*). The capsules contain 30,000 or more seeds, but probably not one seed in ten thousand falls on a suitable place to germinate. The plants require very acid soil and are almost impossible to grow in gardens without special care.

Trailing-arbutus (*Epigaea repens*). Ants generally carry away the seeds as soon as they are ripe. (To obtain them for sowing, the capsule needs to be bagged soon after the flowers wilt.)

Trout-lily (*Erythronium americanum*). Plants are found in moist to dry open woodlands. The first year from seed, they develop a small bulb with a small, narrow leaf. Each succeeding year to the seventh, when they flower, they develop larger and deeper-rooting bulbs with larger leaves. *E. hartwegi* and several similar species found in the Rocky Mountains, the Cascades and Sierras are generally difficult to establish in the East, but some have flowered from seeds in two years.

Wintergreen (*Gaultheria procumbens*). The plants may be grown in an acid soil that is rich in humus.

Closed gentian (*Gentiana andrewsi*). Easiest of the gentians to grow in a damp soil.

Fringed gentian (*Gentiana crinita*). Seeds ripen the latter half of October and should be sown at once in a damp, low meadow. Not easily grown in gardens. The seeds and flowers are similar to those of the Rocky Mountain *Gentiana elegans*.

Beach pea (*Lathyrus maritimus*). A seabeach plant, this can be grown only under natural conditions.

Turk's-cap lily (*Lilium superbum*). Plants grown from seed will eventually develop a scaly bulb which in old plants may be some two feet deep in the ground.

Cardinal-flower (*Lobelia cardinalis*). A plant of low, wet grounds and swamps. Seed should be sown in moist soil, but can be grown in drier places.

Oswego-tea (*Monarda didyma*). Grows naturally in moist, open thickets and woods, but it does well in garden soil.

Rosebay (*Rhododendron maximum*). This and related eastern and northwestern species, including azaleas, as well as most other plants of the Heath family, have small, slender seeds. For germination, fill a shallow pot with sandy woods mold from under oak trees or mountain-laurel bushes, wet down and allow to settle over night. Sow seeds thinly and cover with a thin layer of sphagnum moss rubbed through a sieve; cover with glass and protect from direct sunlight. Leave out over winter.

Golden ragwort (*Senecio aureus*). This, the similar *S. smalli*, and several southern species are among the earliest flowers of the Composite family. Well adapted to gardens, but most of the seed-heads should be cut before they are ripe to prevent the plants taking over the area.

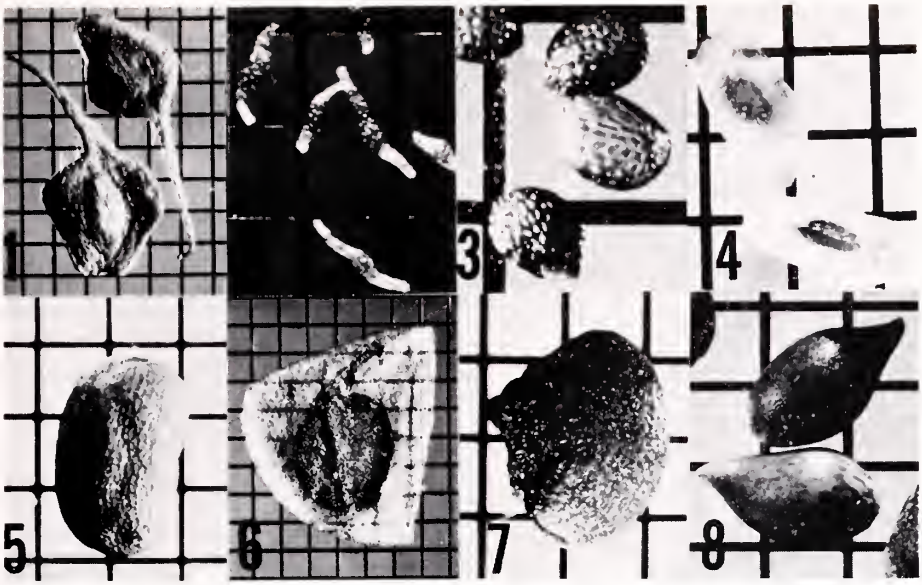
Large-flowered trillium (*Trillium grandiflorum*). A plant of rich woods and thickets, it grows well in partly shaded gardens. The plants bloom in five to ten years from seed and once established they will seed themselves.

Blue violet (*Viola papilionacea*). This is typical of several common blue-flowered species that develop normal seeds in a two-valved capsule; other seeds come from inconspicuous cleistogamous flowers and ripen at the base of the stems.

Bird's-foot violet (*Viola pedata*). Requires dry, acid soil and is difficult to establish.

Southeastern Species

Scorpion-weed (*Phacelia bipinnatifida*). The plants grow in rich, open woodlands



U. S. Department of Agriculture

Seeds of wild flowers are of widely varied form and dimensions. The screen (squares = 1/25 inch) is the same size in the background of all the seeds shown here. 1. Meadow anemone (*Anemone canadensis*). 2. Pink lady's-slipper (*Cypripedium acaule*). 3. Trailing-arbutus (*Epigaea repens*). 4. Closed gentian (*Gentiana andrewsi*). 5. Wild geranium (*Geranium maculatum*). 6. Turk's-cap lily (*Lilium superbum*). 7. Large-flowered trillium (*Trillium grandiflorum*). 8. Blue violet (*Violet papilionacea*).

and require partially shaded garden conditions.

Meadow-beauty (*Rhexia virginica*). Prefers damp areas in sandy or peaty soil.

Rose-pink (*Sabatia angularis*). The plants grow in open woods and fields.

Fire-pink (*Silene virginica*). The plants grow in open woods, thickets, and dry rocky or sandy slopes.

Goat's-rue (*Tephrosia virginiana*). Dry, acid soil is a requirement of these.

Aaron's-rod (*Thermopsis caroliniana*). These plants of wooded mountain areas grow well in gardens.

Prairie and Plains Species

The prairie and plains area is characterized by a deficiency of rainfall, increasing progressively toward the west and south. Most plants of this area are not well adapted to eastern or far western conditions, but some of them can occasionally be induced to grow in other areas, notably in rock gardens, if one provides sandy and gravelly conditions.

In the southwestern plains and often in adjoining desert areas of low annual rainfall, one may occasionally see miles of a three-foot-wide hedge of a single weedy species, like sweet-clover, along paved highways, often accompanied in the background by many plants of less weedy species. This growth may occur a short time after a sudden, heavy downpour and is caused by the heavy run-off from the paved road.

Farther away from paved roads in these areas, unusual heavy rainfall, such as happens once in five or ten years or longer, will produce an almost unbelievable riot of color, in which flowers of the Composite family often predominate. This will give a good idea of what one might do experimentally with seeds of wild flowers of the area by following a dry spell with brief but copious watering.

Species to try:

Sand-verbena (*Abronia fragrans*)

Pasque-flower (*Anemone pulsatilla* var. *wolfgangiana*)

Poppy-mallow (*Callirhoë involucrata*). Parasitic on roots of grass or shrubs.

(*Continued on page* 95)

Gottscho-Schleisner

THE POND at Bowman's Hill State Wild Flower Preserve, Washington Crossing, Pa., surrounded by native ferns. Edgar T. Wherry was one of the leaders in the establishment of this 100-acre reservation, and the winding path among the ferns has been named the Wherry Fern Trail.

NATIVE FERNS IN THE GARDEN

Kinds to grow and not to grow, together with tips on cultivation

Edgar T. Wherry

EVERYONE who develops a wild garden will surely wish to have ferns along with flowers. Here are some of the most interesting and easily grown of the 100 native sorts in the northeastern United States.

Woodland Ferns

Christmas fern (*Polystichum acrostichoides*). This is our commonest evergreen, able to grow in a wide variety of shaded habitats, and thriving especially well in rather infertile soil. It forms solitary clumps and its rootstocks spread very slowly. In autumn the one- to two-foot fronds fall to the ground, forming mats which retard soil erosion and in time build up humus in which many delicate wild flowers find a congenial home.

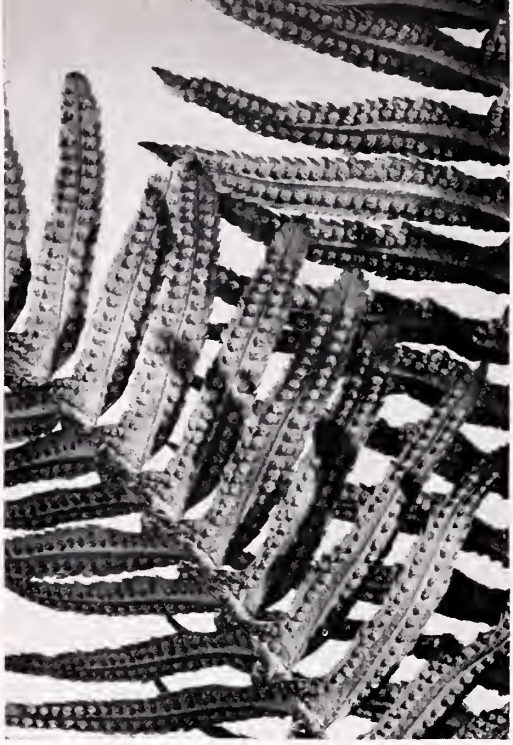
Marginal wood fern (*Dryopteris mar-*

ginalis). Even more adaptable than the Christmas fern, this evergreen species thrives in seemingly inhospitable situations, thorough drainage being its chief requirement. Most luxuriant on wooded slopes. When its roots extend deep into crevice humus among rocks it can withstand considerable sun.

Fancy fern (*Dryopteris intermedia*). This is the lacy evergreen fern of which millions of fronds are gathered annually in the New England uplands for the florist trade. It does best in well shaded humus-rich loam, and like the others is a good soil builder on wooded slopes. These three evergreens should be brought into every fern garden.

Maidenhair fern (*Adiantum pedatum*). Foremost of the deciduous sorts for the woodland garden is this unique species, with its lovely fan-shaped blades borne aloft on foot-high shining black stalks. It

CINNAMON FERN (*Osmunda cinnamomea*). The spores are borne in spring on leafless stalks that rise from the center of the plant. They soon turn cinnamon brown. Widely adaptable.
Roche



Roche

UNDERSIDE OF FERN FROND. The dots are clusters of spore cases, and each dot is called a "sorus."

is readily grown in damp, but well-drained humus-rich soil, and spreads by rootstocks into splendid patches.

Southern beech fern (*Phegopteris hexagonoptera*). The blades of this species have a striking triangular outline, being often six to eight inches in both length and breadth. Its slender rootstocks run rapidly through the litter on wooded slopes so that its colonies are rarely dense.

Tapering ("New York") fern (*Thelypteris noveboracensis*). Since this fern has no manifest connection with New York, a preferable colloquial name is the one referring to the way the foot-long blade tapers at both ends. It increases slowly by rootstocks to form good-sized clumps, thriving best in rather damp, subacid humus.

Rattlesnake fern (*Botrychium virginianum*). This is a "grape fern," characterized by bearing its spores not on the back of the blade but in numerous globular spore-cases clustered at the tip of a separate stalk. The blade is broadly triangular and cut in a delicate lacy pattern; it is borne aloft on a stout fleshy stalk, which may be a foot or more long. It does not spread by rootstocks, but its spores germinate freely, yielding colonies made up of individuals of assorted ages and sizes. This fern is easy to grow in damp woodland humus.

Interrupted fern (*Osmunda claytoniana*). If there is room in the woodland garden for a rather massive fern, this member of the Royal Fern family merits consideration. It thrives in richer soil than its relatives, its oblong fronds often attaining a height of three or four feet. The name refers to the way the dense clusters of tiny globular sporangia interrupt the otherwise continuous rows of lobed green pinnae, in the more luxuriant clumps.

Moist Woodland Ferns

Ostrich fern (presently accepted technical name *Matteuccia pensylvanica,* but over the years assigned numerous different combinations). The striking three- to four-foot plumes of this fern grow in a beautiful vaselike group. They tend to become shabby by late summer, at which time shorter blackish cornblike structures bearing the spores arise. Something of a rootstock-spreader.

Giant wood fern (*Dryopteris goldiana*). While similar to the preceding in stature, the blade is relatively short, broad, and less divided; its upper surface shows a striking color-play from dark to pale bluish green. Spreads very slowly.

Glade fern (*Athyrium pycnocarpon*), (once mistakenly called "narrow-leaved spleenwort"). The long narrow pinnate blade of this species, though not cut in the traditional lacy or "ferny" pattern, is so delicate and graceful as to deserve garden use. While capable of forming good-sized patches, it does not crowd out other ferns.

Silvery glade fern (*Athyrium thelypterioides*), (also no longer classed as a "spleenwort"). This differs from its relative in being more hairy and coarser-

textured, and having the pinnae cut into blunt lobes. The colloquial name refers to the way the indusia covering the chevronlike sori take on a striking silvery sheen. Its rootstocks are a bit aggressive.

Moist Acid-soil Ferns

American climbing fern (*Lygodium palmatum*). This is unique among our ferns. Its fronds climb or twine over bushes to a height of two or three feet. In spite of its belonging to a largely tropical family, its foliage is evergreen. It can be expected to thrive only in highly acid, permanently moist soil. How demanding it is in this respect was brought out by a recent experience in Hartford, Connecticut. A fern gardener who had grown it successfully for years, watering its pots with city water, had it weaken and nearly die in the autumn of 1960. On inquiry at the water works, he found that the formerly acid reaction of the water had been brought to neutrality by liming and thus was poisoning the fern. By treating the water with aluminum sulfate before application, he soon brought his ferns back to health.

Royal fern (*Osmunda regalis*). A massive plant, with a huge trunklike root mass and fronds several feet long. The lobes of the fronds resemble locust-tree leaflets. While thriving best in highly acid soil, it is less sensitive in this respect than the preceding.

Cinnamon fern (*Osmunda cinnamomea*). Similar to its relative in stature and in soil relations but with simpler leaves. It can be readily distinguished from the similarly lobed interrupted fern, treated above under Woodland Ferns, by a tuft of brownish hairs at the base of each leaf lobe. The spores are borne on leafless stalks which arise early in spring and soon turn cinnamon-brown.

Rock Ferns

In transplanting any fern from its native haunts, it is best to trim off considerable foliage to prevent moisture loss before new roots form. This is especially important in connection with rock ferns,

Roche

INTERRUPTED FERN (*Osmunda claytoniana*). Native to moist woods. Grows well in shady gardens.

for in removing them from the crevices, many fine roots are inevitably broken off.

Rock-cap fern (*Polypodium virginianum*). The brown-scaly rootstocks of this striking evergreen wind their way through mats of humus perched on rocks or logs, thus avoiding contact with ordinary soil, which poisons it and other ferns of similar habit. When moving it, cut off most of the blades, and weight down the humus-mat for a season.

Blunt-lobe cliff fern (*Woodsia obtusa*). One of the easiest rock ferns to grow, being tolerant of a considerable variety of habitats, and even able to occupy woodland humus soil. The lightly scaly fertile

fronds, six inches or more tall, are deciduous, but smaller prostrate sterile ones are evergreen.

Bulblet fern (*Cystopteris bulbifera*). This is named in old-fashioned fern books the "bulbiferous bladder fern," but that sounds rather pathological to moderns. It will grow in crevices of various rocks, but is at its best in limestone. The pink-stalked fronds have a gracefully tapering pinnate blade up to two or three feet long. At intervals along the upper blade small bulblets are borne. These fall off, take root and grow into new plants.

Walking fern (*Camptosorus rhizophyllus*). Another method of vegetative reproduction is referred to in this colloquial name. The long-tapering, unlobed blade, a few inches in length, takes root at its slender tip, so that new plants seem to be walking over the mossy rocks. This odd fern thrives best on cool, moist limestone. It may have to be protected from slugs in summer and mice in winter.

Ferns to Avoid

Several common ferns, while they may be more or less attractive, spread so pervasively by rootstocks that they are best kept out of any modest-sized fern garden. Five especially obnoxious ones are:

Hay-scented fern (*Dennstaedtia punctilobula*)

Lady fern (*Athyrium filix-femina.*)

Marsh fern (*Thelypteris palustris*)

Bead or "sensitive" fern (*Onoclea sensibilis*)

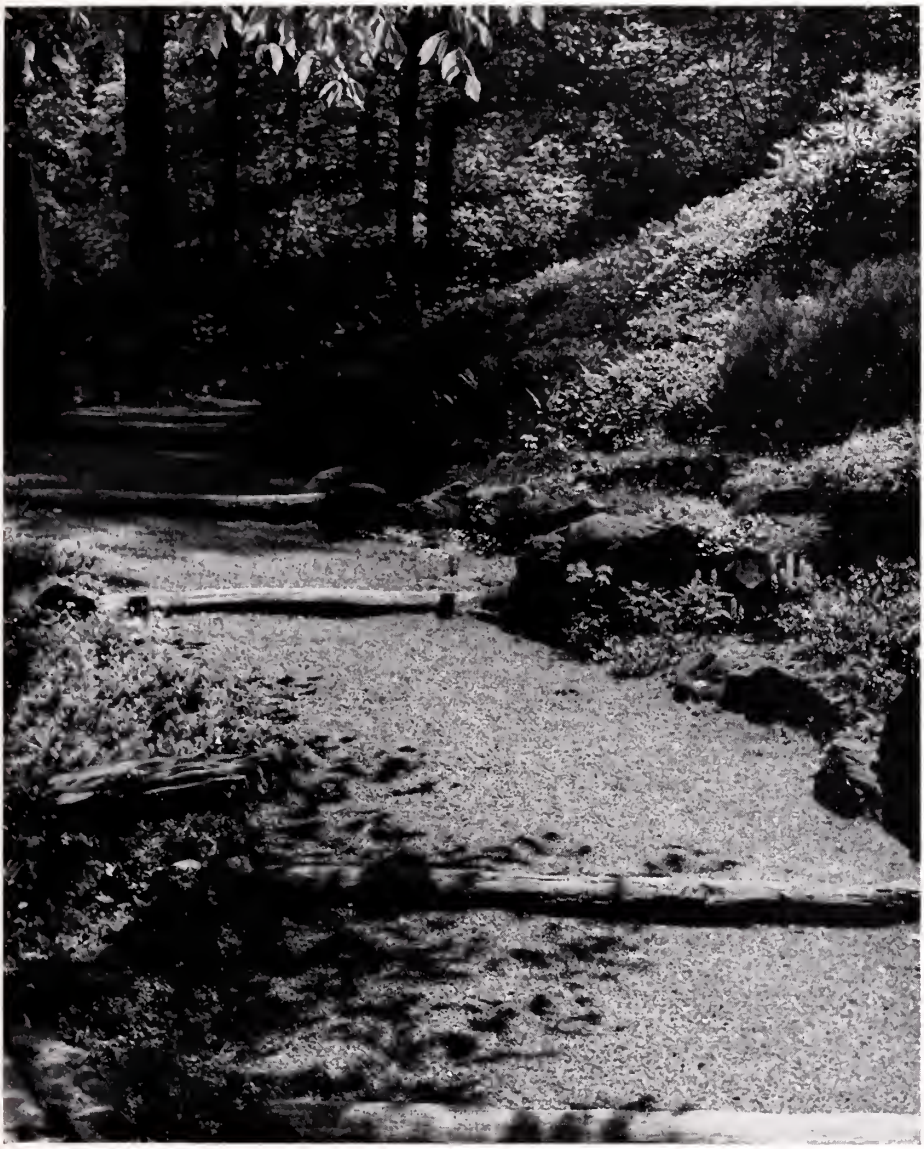
Bracken (*Pteridium aquilinum*).

Roche

NORTHERN MAIDENHAIR FERN (*Adiantum pedatum*). Lacy fan-shaped fronds are borne on foot-high shiny black stalks. Readily grown in well-drained humus-rich soil.

NATIVE PLANTS IN GARDENS

With portraits of some choice wild species that respond to cultivation



Roche

WOODLAND WALK

Rancho Santa Ana

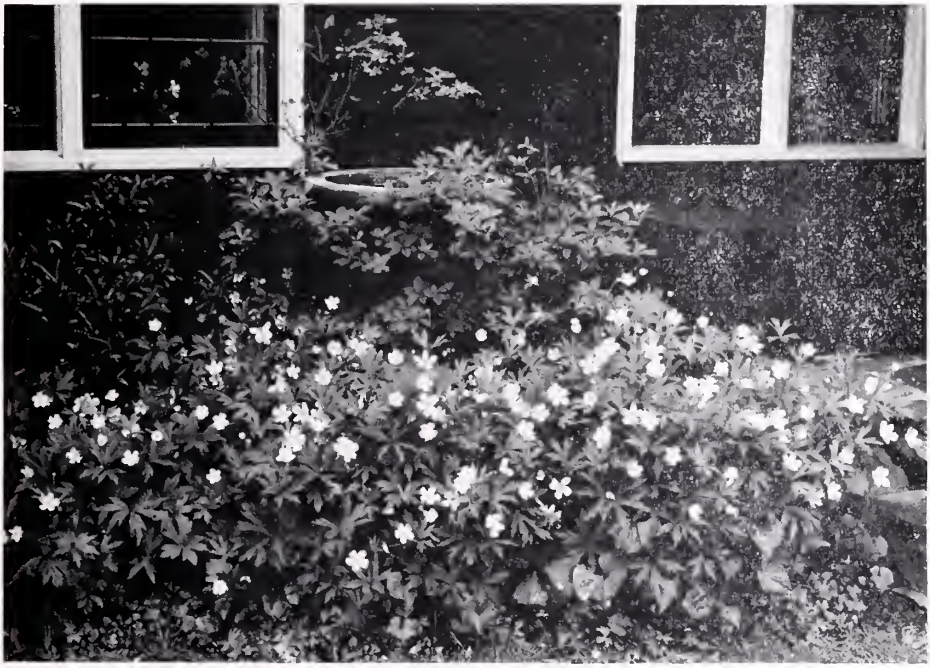
COREOPSIS MARITIMA appropriately placed beside a pool in a California garden. A few blooms of California poppy can be seen at the left.

Roche

RHODODENDRON CAROLINIANUM. This native of North Carolina does well in woodland planting farther north in the eastern states.

Molly Adams

FERNS of a number of kinds, irises, and meadow-rue are among the wild plants brought into this streamside garden.



Roche

CANADIAN ANEMONE (*Anemone canadensis*) grows here, along with shrubs, beside a house.

McFarland

PINKSHELL AZALEA (*Rhododendron vaseyi*) with companion planting of shade-loving wild flowers (trillium, dicentra and mertensia) in a woodland garden at the edge of a lawn.

NOTE: On the next six pages, except in the color section, wild flowers are arranged in the alphabetical order of their botanical names.

M. & M. Carothers

SAND-VERBENA (*Abronia villosa*), a western native, requires well-drained soil.

McFarland

PASQUE-FLOWER (*Anemone pulsatilla*), is one of earliest to bloom in North.

Gottscho-Schleisner

COLUMBINE (*Aquilegia canadensis*). This plant is a favorite in wild-flower gardens everywhere; adaptable in sun or shade, rocks or woodland.

Roche

JACK-IN-THE-PULPIT (*Arisaema triphyllum*). This novel plant is a favorite, whether in the woods or in wild-flower gardens. Grows best in moist situations.

John H. Gerard from NAS

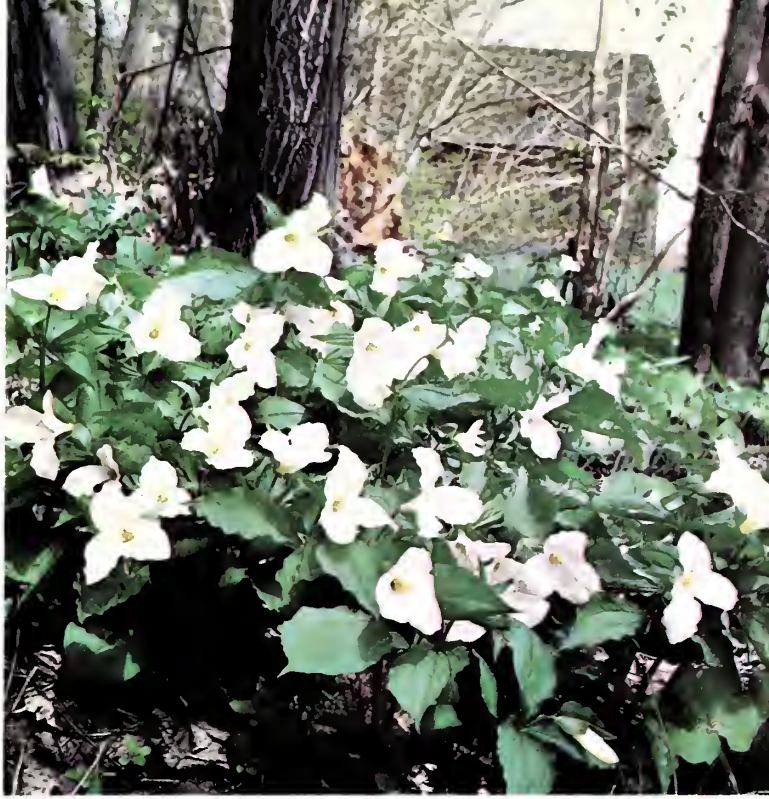
NEW ENGLAND ASTER (*Aster novae-angliae*). Its light purple flowers bloom in autumn in sunny gardens and along roadsides. Many hybrids have been developed.

Charles J. Ott from NAS

MARIPOSA-LILY (*Calochortus gunnisoni*). One of the many kinds of beautiful mariposa lilies of the western states.

McFarland

BUNCHBERRY (*Cornus canadensis*). This dwarf dogwood, a northern plant, requires a woods soil and cool root-run.



Trillium (*Trillium grandiflorum*). Of the many native trilliums, this large white-flowered grandiflorum is highly regarded for wild-flower gardens. The western species *Trillium ovatum* is similar in appearance.

Malak

Marsh-marigold (*Caltha palustris*). Often known as cowslip in earlier days. Found in wet places, its bright yellow flowers gladden springtime.

Groffman

Cardinal-flower (*Lobelia cardinalis*)

Yellow lady's-slipper (*Cypripedium pubescens*)

Butterfly-weed (*Asclepias tuberosa*)

Double form of bloodroot (*Sanguinaria canadensis multiplex*)

Gottscho-Schleisner photos

McFarland

SHOOTING-STAR (*Dodecatheon meadia*). This and other species of shooting-star are garden favorites from coast to coast.

Rancho Santa Ana Botanic Garden

CALIFORNIA-POPPY (*Eschscholzia californica*) may be grown as an annual in sunny gardens of many climates, where it will self-sow.

HEPATICA TRILOBA is one of the first to bloom of the spring wild flowers. Desirable and choice, but sometimes difficult to maintain.

Gottscho-Schleisner

Richard L. Weaver from NAS

RATTLESNAKE - PLANTAIN (*Goodyera pubescens*), a small summer-flowering orchid that transplants satisfactorily.

BLAZING STAR (*Liatris pycnostachya*). Lavender wands to 3 feet tall make striking plants for sunny summer gardens.

John H. Gerard from NAS

Henry M. Mayer from NAS

PURPLE FRINGED ORCHIS (*Habenaria fimbriata*), a handsome plant of cool moist woods and a challenge to the gardener.

FIVE-SPOT (*Nemophila maculata*) is a favorite California annual.

Rancho Santa Ana Botanic Garden

Roche

WATER-LILY (*Nymphaea odorata*). Fragrant white blooms float on the surface of the water. Easy to establish in a garden pool.

Roche

PRICKLY-PEAR CACTUS (*Opuntia*), for the sunny rock garden. There are 200 American species, mostly western, but this one grows eastward to southern New England.

Gottscho-Schleisner

MAY-APPLE (*Podophyllum peltatum*). Waxy white flowers under open green umbrellas will colonize in shade.

Roche

EARLY SAXIFRAGE (*Saxifraga virginiensis*) is an eastern saxifrage that can be grown in rock crevices in sun. Western species are more spectacular in cultivation.

Roche

OCONEE-BELLS (*Shortia galacifolia*), the "lost plant" of North Carolina, and an early spring flower. Prized in gardens in the North, in woods soil with good drainage.

Roche

YUCCA. This southeastern yucca is hardy in the North.

WILD FLOWER BOOKS

Regional and general guides for selecting and identifying native plants

G. H. M. Lawrence

THE literature on native American plants is voluminous, even when one considers only books and not the equally important but scattered material that appears in hundreds of periodicals. Unlike such subjects as plant growth or plant diseases, where yesterday's books are literally outdated by those published today, the descriptive and illustrated literature about the plants themselves is rarely if ever wholly outdated. This means that Faxon's beautiful plates in Sargent's *North American Sylva* are as valid today as when published between 1891 and 1902. In fact, some of our earlier floras are better tools for identification than some of the later ones; it is only because the recent books are more readily available that they are here given greater attention.

The number of climatic zones in our country is one of the reasons why many books are needed for acquiring knowledge about native plants that are adapted to cultivation. Twelve zones are now recognized, and these are beautifully delineated in the plant hardiness zone map published by the U. S. Department of Agriculture. For purposes of this brief account, however, it will suffice to distinguish only among the major geographic sections of the country, remembering that within each of these there may be a series of climatic zones. For practical purposes, these geographic sections of the country may be designated as follows:

Northeastern United States and Canada
Southeastern United States
Western States (west of the Mississippi River, excluding the Pacific Coast and Alaska)
Pacific Coast States (California, Oregon, Washington, Alaska)
Hawaii

Botanical works that treat the plants of these sections are to be found in the libraries of most botanical gardens, the larger garden centers and horticultural institutes, the larger municipal public libraries, and most colleges and universities having departments of botany or horticulture. Persons seeking more detailed listings of this literature should consult Blake & Atwood: *Geographical Guide to Floras of the World,* Part I (1942) (U. S. Dept. of Agr. Misc. Publ. No. 401), or the more condensed popular work by S. F. Blake: *Guide to Popular Floras of the United States and Alaska* (1954) (U. S. Dept. of Agr. Bibliographical Bulletin No. 23). The works cited below are either those of more general scope, or are those believed especially useful to the flower lover because of their less technical detail or for their fine illustrations.

Northeastern United States and Canada

Durand, Herbert. *Field book of common ferns.*

Gleason, Henry A. *The new Britton and Brown illustrated flora of the northeastern United States and adjacent Canada.* 3 vol.

Gottscho, Samuel H. *Wildflowers; how to know and enjoy them.*

Graves, Arthur H. *Illustrated guide to trees and shrubs.* Both native and cultivated plants.

Fernald, Merritt Lyndon. *Gray's manual of botany.* Ed. 8. A technical manual, the most complete for the region.

Fernald, Merritt Lyndon & Kinsey, Alfred C. *Edible wild plants of eastern North America.* Rev. by Reed C. Rollins.

House, Homer D. *Wild flowers.*

Wherry, Edgar T. *Wild flower guide,* also *The fern guide.*

Wiley, Farida A. *Ferns of northeastern United States. A pocket manual for the amateur.*

Southeastern United States

Dormon, Caroline. *Flowers native to the Deep South.*

Greene, Wilhelmina F. and Blomquist, Hugo L. *Flowers of the South, native and exotic.*

Small, John K. *Ferns of the southeastern states.*

Small, John K. *Manual of the southeastern flora.* A technical manual.

West, Erdman and Arnold, Lillian E. *The native trees of Florida.*

Western States

(West of Mississippi River, excluding Pacific Coast States)

Benson, Lyman. *The cacti of Arizona.* Ed. 2.

Clements, Edith S. *Flowers of prairie and woodland.*

Clements, Frederic E. and Edith S. *Rocky Mountain flowers. An illustrated guide for plant-lovers and plant-users.* Ed. 3.

Hardy, George A. and Winifred V. *Wild flowers in the Rockies.*

Longyear, Burton O. *Trees and shrubs of the Rocky Mountain region with keys and description for their identification.*

Pesman, M. Walter. *Meet the natives.*

Rydberg, Per Axel. *Flora of the Rocky Mountains and adjacent plains.* Ed. 2. A technical manual.

Vines, Robert A. *Trees, shrubs and woody vines of the Southwest.*

Pacific Coast States

(California, Oregon, Washington, Alaska)

Abrams, Leroy. *Illustrated flora of the Pacific states, Washington, Oregon, and California.* 4 vols. A technical manual. The most comprehensive and best illustrated work available for the region.

Cornell, Ralph D. *Conspicuous California plants.* A landscape architect's view.

Everett, P. C. *Culture of California plants.*

Gilkey, Helen M. and Powell, Garland M. *Handbook of northwest flowering plants.* Ed. 2.

Haskin, Leslie L. *Wild flowers of the Pacific coast.*

Hitchcock, C. Leo, et al. *Vascular plants of the Pacific Northwest.* In 5 parts (incomplete).

Lenz, Lee W. *Native plants for California gardens.*

Munz, Philip A. *California spring wildflowers,* also *California desert wildflowers.*

Munz, Philip A. and Keck, David D. *A California flora.*

Parsons, Mary Elizabeth. *The wild flowers of California: their names, haunts, and habits.* Rev. ed.

Sharples, Ada W. *Alaska wild flowers.*

Hawaii

Kuck, Loraine E. and Tongg, Richard C. *Hawaiian flowers and flowering trees.*

Neal, Marie C. *In gardens of Hawaii.* A manual of the cultivated ornamentals.

General

In addition to the wild-flower books cited above, some of recent date are of broader scope than is indicated by the geographic regions. Notable among these are:

Hull, Helen S. *Wild flowers for your garden.*

Mathews, F. Schuyler. *Field book of American wild flowers.* Rev. by Norman Taylor.

Rickett, Harold William. *Wild flowers of America.*

Steffek, Edwin F. *Wild flowers and how to grow them.*

Taylor, Kathryn S. [Ed.] *A traveler's guide to roadside wild flowers, shrubs and trees of the U. S.*

Illustrations of Flowers

One frequently wishes to find an illustration of a plant, perhaps for reproduction purposes or more often as a basis for identification. There is a work little known by most flower lovers that provides an index to all the published illustrations of plants that are labeled with a Latin name. This is *Index Londinensis,* published by the Royal Horticultural Society (London) in four volumes (1920-31) with a two-volume supplement (1941). Here will be found an alphabetic listing of Latin names of plants, accompanied by references to published illustrations of them. This important index is to be found in the libraries of all leading botanic gardens and centers and in the larger municipal public libraries.

NATIVE ORCHIDS OF FLORIDA

Terrestrials that are difficult to cultivate—
and epiphytes that are easy

Mary Noble

THE increased interest of amateurs in growing unusual orchids is drawing attention to the kinds that grow wild in Florida.* Although only a dozen of the 85 species native there are so far being cultivated, it is likely that more will soon be added to collections. Some are being used for hybridization; other are being given a place all their own. This cultivation may be a significant factor in saving some of the species from extinction.

While several indigenous orchids are protected by conservation laws, they are often destroyed by "progress" as civilization moves into additional natural areas. Bulldozers rumble across the meadows and through the forests, until today the wild orchids are making their last stand in remote undeveloped areas.

Only a few of the native orchids resemble the commercial cut-flower types, but many of them have flowers that are exquisite. All possess the typical characteristics of the *Orchidaceae,* notably the showy petal called the labellum, or lip. The species that grow there are not limited to Florida. Some of the epiphytes are believed to be immigrants from the Caribbean; some of the terrestrials range northward to Canada, even Alaska. An Asiatic species which has appeared is an enigma.

Within this group of natives, flowers can be found around the calendar. The epidendrums have long and varied blooming seasons. We have gathered habenarias in late summer. *Ionopsis utricularioides* appears in both fall and winter orchid shows.

The epiphytic orchids—those that grow mostly perched on trees—are quite different in their basal structures from those that have roots in the ground. Their cultural requirements also vary considerably from those of the terrestrial species.

Terrestrials

The ground-dwelling orchids offer a wide selection of little known genera which are usually found in low, wet places. Some tend to be aquatic. They grow in the shifting shade of tall pine trees, in tropical hammocks, roadside ditches, and open meadows.

The foliage of these orchids is generally inconspicuous; sometimes it is grassy, sometimes arranged in rosettes. It would be almost impossible for a layman to identify these plants except by their flowers. Many have bulbous roots or extremely fleshy root systems.

Some terrestrials, such as *Cleistes divaricata,* may be found in bogs, hidden under the enormous fronds of the osmunda fern. This species has beautiful large pink and brown flowers, and blooms for Mother's Day in May.

The grass-pinks (*Calopogon pulchellus*), on the other hand, like more sun, and a colony of these starry, fuzzy-lipped flowers gives a rosy glow to an open field. This species has a wide geographical range, covering the eastern half of the United States and extending into Canada.

The rose pogonias (*Pogonia ophioglossoides*) also are widely distributed, ranging from Newfoundland to Texas. They produce charming pink flowers, two inches across, on upright stems. These orchids are found scattered among other spring

*A splendid reference on these native plants is *Drawings of Florida Orchids* by Blanche Ames, with explanatory notes by Oakes Ames. Printed in 1947 by the Botanical Museum of Harvard University, Cambridge, Mass. Second edition (1959) available through the South Florida Orchid Society, Inc., 9822 N. E. 2nd Ave., Miami Shores 38, Florida.

Helen G. Cruickshank from NAS

LADIES-TRESSES (*Spiranthes cernua*), a marsh orchid of eastern United States with spiraled white blossoms in August; one of 16 species known in Florida.

field flowers in swamps, cranberry bogs, coastal areas, and mountains. A white form, *albiflora,* is rare.

Twelve species of *Habenaria* are found in Florida in sunny, damp situations. They have large spikes crowded with flowers, some more spectacular than others. Especially deserving attention are *H. blephariglottis* and *H. ciliaris,* one white and the other orange, both with minutely fringed lips and long spurs.

The *Spiranthes,* of which 16 species are listed in Florida, can be described best by a twist of the hand—like a circular staircase. Their spikes are abundant along highways where the ground is damp, but the flowers are so tiny and often such a dingy white that they do not catch the eye! This genus also is widely distributed.

Zeuxine strateumatica is of Asian origin and was first noticed in Florida in 1936. It has spread so extensively, colonies of them even popping up in lawns, that it is now considered a weed. Oddly enough, it quite often makes a surprise appearance in pots of cultivated orchids in greenhouses. The spikes are one-half inch wide and two to three inches long, on short stems. The minute flowers are crowded together, and of interest only as curiosities. However, when zeuxines first appeared those of us who searched for them considered each inflorescence a treasure.

Except for the intruding and persistent *Zeuxine,* the native terrestrials do not take kindly to cultivation, no matter how carefully they are dug from their locations. Old records show that *Calopogon pulchellus* was cultivated in Holland in the mid 1700's but it is grown today in few, if any, Florida gardens. The preference of the native terrestrials for wet ground makes their survival in cultivation difficult, as most gardeners make every effort to keep their gardens well drained.

The Epiphytes

The native epiphytic orchids, with a few exceptions, are easily adapted to garden or greenhouse culture. They may be planted in any of the acceptable potting mediums—tree fern, osmunda fiber or fir bark, and they adjust to having their roots confined if they are not overwatered. Or they may be suspended on tree-fern slabs. In the warm areas of South Florida native epiphytes may be fastened to live on driftwood trees, or nestled in the boots of palm trees. ("Boots" are the stumps of old fronds that surround the trunks of some species of palms.)

Many figure prominently in old literature, as plants were collected in Central Ameri-

ca and the West Indies and shipped to Europe a hundred and more years ago. Quite a few are included in Williams' Seventh Edition,* still a standard reference for orchid growers.

With one exception, the epiphytes are confined to peninsular Florida and in other areas must have winter protection in a greenhouse. The hardy exception is *Epidendrum conopseum,* found up the East Coast into North Carolina, and along the Gulf Coast to Louisiana and Texas. This species grows in crowded clumps, mostly on oak tree limbs, in company with resurrection ferns and Spanish moss. It has small, stiff, glossy leaves, one or two inches long and half an inch wide, on four-inch stems. The flowers are widely spaced, several to a spike. They are of the typical cattleya form but only one-half inch wide. Their watery green color makes them almost invisible, even in full bloom.

Epidendrums cross readily with cattleyas, laelias, and other related genera, and a few Florida hobby growers are breeding this genus with others that have showier flowers to achieve more interesting blooms on plants sufficiently cold-resistant to grow outdoors in northern Florida. To date some fourteen hybrids of *E. conopseum* are in the seedling stage. *Epidendrum nocturnum, E. difforme, E. anceps, E. rigidum* and *E. strobiliferum* are, like *E. conopseum,* among the species without pseudobulbs, but these are less interesting than the bulbous epidendrums.

The best known member of the genus is *E. tampense,* which has attractive flowers of yellowish or greenish brown with bright magenta marks on the lip. These one-inch boutonnière-sized blooms are produced on spikes arising from egg-shaped pseudobulbs. They are garden favorites in the warmer parts of the state, and adapt easily to pot culture in greenhouses anywhere. The demand for this species will increase because of the growing interest in diminutive orchids.

Epidendrum cochleatum was one of the first orchids imported into Europe; it flowered at Kew in 1787. The popular name, cockle-shell, describes the shape of the lip, which is as near black in color as any orchid. The sepals and other petals are pea-green. The flowers open a few at a time so that the plants are in bloom almost continuously. This species has flat bulbs, broad at the base and narrow at the top.

Cyrtopodium punctatum, called cow horn because of the long pointed bulbs, produces the largest plants among Florida's orchids. The one-and-one-half-inch flowers, on long spikes, are showy because of their quantity, but as individuals they are odd rather than pretty. This species, named by Linnaeus in 1759, was in cultivation in Europe long before that date.

Brassia caudata, one of the spider orchids, is of commercial importance, but is extremely rare in Florida and the only member of the genus indigenous here. Most of the plants in cultivation are imported from growers in the West Indies or Central America.

The oncidiums are favorites wherever orchids are grown because of their graceful sprays and charming blooms. Of the four species native to Florida the best known is *Oncidium luridum,* which has arching sprays of yellow and brown blooms more than an inch wide. However, many of the other oncidiums in cultivation are more attractive.

Oncidium variegatum is a true miniature with leaves like toothpicks in a fan design and not more than three inches in length. The little blooms are of the typical dancing-lady type, greenish brown and less than one-half inch in size. This species grows best on tree-fern slabs, as the new foliage appears on a stem at a different level from previous growth.

A recent favorite is *Ionopsis utricularioides,* one of the daintiest of the natives. It has spreading racemes of small lavender blooms with oversized, lobed lips. Flower arrangements and show exhibits benefit from its light, airy appearance. Plants for cultivation are imported from the Caribbean.

*The Orchid Grower's Manual, B. S. Williams and H. Williams. London, 1894 (7th edition). Reprinted 1961.

NATIVE PLANTS FOR SOUTHERN GARDENS

Wild plants that make fine ornamentals in Louisiana

Caroline Dormon

OF ALL the native southern shrubs adaptable to cultivation, the oakleaf hydrangea (*Hydrangea quercifolia)* should head the list. In spring the tall spires of white flowers cover the plant. These retain their whiteness for several weeks, then gradually take on lovely tints of rose. In late fall the leaves become a rich dark red. It is easy to transplant, and soon forms a nice clump. It does best in a loose and somewhat acid soil, with plenty of humus, but will also succeed in neutral soil. It thrives on rocky hillsides and in lowlands. The flowers are whiter and more attractive with some high shade.

Oddly enough, few gardeners in the Deep South seem to know that mountain-laurel (*Kalmia latifolia*) does well in cultivation. Here at Briarwood, in the sand hills of northwestern Louisiana, I have magnificent specimens thirty years old which are masses of pink flowers in spring. I find them easier to grow than our native azaleas. As with dogwoods, drought in late summer and early fall cuts down the number of flower buds, which form at this time. Of course kalmia, like all the heaths, must have acid soil, loose and full of humus and well drained. It occurs in the wild in the eastern part of the state.

Our native azaleas tempt gardeners, and many have been destroyed by being brought in from the wild and planted in unsuitable locations. These lovely things should never be attempted unless one can supply what they want: loose acid soil, plenty of humus, moisture, and perfect drainage. The native southern pink *Azalea canescens* is difficult. *A. austrina,* in various shades of yellow, is easier, and blooms beautifully on a cool hillside below my house. But the best subject for horticulture is the dwarf *A. alabamense,* the fragrant flowers white, with one yellow spot. It will grow in drier situations than any of those I have tried.

Another attractive member of the Heath family is *Pieris nitida,* with arching stems, small evergreen leaves and, in spring, clusters of small flesh-colored flowers. The closely related *Leucothoë catesbaei* is more beautiful, but also more difficult. I do grow it successfully at Briarwood, but in a cool damp spot, and very acid.

When I see a well developed plant of *Aronia arbutifolia,* I wonder that more gardeners don't have it. It needs to be topped often or it will become "leggy." The clusters of dainty flowers are like tiny apple blossoms, and in the fall the shining fruits are brilliant red. I have seen plants not more than 15 inches high crowned with umbels of the showy berries. Happily, this is a shrub which will grow almost anywhere.

Where space permits, native roses should never be omitted. The true Cherokee, *Rosa laevigata,* festoons trees with great white flowers, as is beautifully demonstrated at Cypress Gardens, near Charleston. The prairie rose, *R. setigera,* gives us clusters of delicate pink blossoms, but it too must have room to grow. There is a dwarf species, close to *R. carolina,* which bears its pink flowers when not more than a foot high, and the bright-red hips hold all winter. It must be watched, however, as it spreads by root-runners.

Among trees, of course the dogwood (*Cornus florida*) is indispensable. And no large garden in the South is complete without at least one fine specimen of *Magnolia grandiflora.* The sweet-bay

McFarland

SWEET-BAY OR SWAMP MAGNOLIA (*Magnolia virginiana*), evergreen in the South, but deciduous and hardy in the North. Fragrant white flowers with the leaves in late spring are followed by bright red fruits in autumn.

(*M. virginiana*) is less showy, but very attractive, with its fragrant flowers and leaves that are silvery underneath—beautiful in a high wind. The variety west of the Mississippi grows very large, and the flowers are five inches in diameter.

McFarland photos

BROWN-EYED SUSAN (*Rudbeckia triloba*), 2- to 5-foot biennial, New England southward and westward. Golden yellow flowers in late summer. Grows in dry or moist ground. Other brown-eyed Susans are also easily adapted to garden use.

Wild Flowers in Their Season

A spring garden with native plants is charming, with the many wild verbenas and phloxes, in all shades of lavender, pink, and white. Violets will carpet the ground. Indian-pink (*Spigelia marilandica*) adds a dash of red, and is easy to grow. Jack-in-the pulpit and trillium add interest in shaded spots. Alas, the various trilliums with white and bright-hued flowers will not persist at Briarwood; only the brown *T. ludoviciana* is happy here. But the mottled leaves make a lovely ground cover. For the rock garden, there are species of *Silene* that form mats, and cover themselves with exquisite pink or white flowers. *S. wherryi* is one of the best, with flowers of clear pink. For ground cover, nothing could be more attractive than the wild gingers, *Asarum shuttleworthi* being the prettiest, with its mottled leaves.

Summer brings such a flood of hardy native flowers that a wild garden for this season is easy. But nothing else gives me quite the joy I feel in the morning display of *Oenothera rhombipetala,* especially when growing with glowing wine-cups. With me, the latter is *Callirhoë papaver*—the flowers larger and redder

than those of *C. involucrata*. The oenothera is low and spreading, the flowers true primrose yellow, the slender buds spotted with light red. A bright shade of red is supplied by dazzling *Erythrina herbacea*. In the fall, its scarlet beans are lovely.

Fall, too, gives us many plants that thrive in the garden. There are a number of rudbeckias, but my favorite is *R. triloba*, which is also native in the North. A little later the sunflower (*Helianthus angustifolius*) fills fence corners with bright gold. With goldenrod also blooming we need lavender to break up the golden shower. *Liatris* (*Laciniaria*) in a number of species and the dainty wild asters supply just the right note. And in moist spots, we may enjoy the beautiful clear red of cardinal-flower.

I have made no mention of orchids, for our terrestrial species are not garden plants, and every effort should be made to preserve them in their native habitat, for some are becoming very rare.

To round out the year we have the unbelievable blue of closed gentian (*Gentiana saponaria*). This can be successfully grown in a garden blessed with a natural bog, or at least a very moist spot. I have found that the plants like sun if their feet are damp. They then produce immense clusters of the beloved flowers.

Ferns in the Garden

The larger ferns, such as the handsome osmundas, grow naturally in my woods, so I have never planted them in the garden. Also, they require a great deal of moisture, so would be difficult to establish and maintain.

Holly fern (*Polystichum lonchitis*) is so attractive it is strange that it is so hard to find in the market. Its shining evergreen leaves and its willingness to grow under intolerant trees, such as live oaks, make it a valuable addition to the large garden. It is quite hardy in Louisiana, but must have rich, rather heavy soil. The Christmas fern (*Polystichum acrostichoides*) succeeds in rather dry locations, if given rich soil and shade.

Of the species suitable for rock gardens, *Woodsia obtusa* is one of the most desirable. The dainty fronds tend to flatten out and never become very tall. It has the lovable habit of sending its spores abroad, and coming up between rocks in the most unexpected places! *Asplenium platyneuron*, with its slender sword-like leaves and brown stems, is lovely between rocks, and can stand a good bit of drought, but it can not always take our hot summers. The several *Cheilanthes* grow in rather dry pockets between rocks, and their downy, lacy, fronds are lovely. I found *C. lanosa* growing between huge sandstone boulders in the hills of northern Louisiana, but even it wanted shade and some moisture when transplanted.

WILD GINGER (*Asarum shuttleworthi*). The mottled evergreen leaves of this species make a slow-growing but valuable ground cover in the wild garden.

McFarland

NATIVE LOUISIANA IRISES

Ira S. Nelson

THE change of status of Louisiana irises from interesting wild flowers to that of accepted garden subjects has come about largely during the past twenty years, although earlier attempts were made over the past 150 years. Some factors which played important roles in this development include the publicity given to this group of irises by Dr. John K. Small's writings in *Addisonia* during the late twenties and thirties, the great variation found among the natural hybrids, the discovery that these plants could be grown under ordinary garden conditions, the need for a garden iris adapted to the Deep South, and the discovery of the Abbeville irises. Amateur hybridizers are almost totally responsible for the good garden hybrids.

Nelson

THE ABBEVILLE IRIS (right), apparently a robust form of *Iris fulva* (left), is responsible for many fine garden hybrids.

Any attempt to generalize about Louisiana irises must necessarily end in frustration, for they are not a homogeneous group. The range of flower colors, shapes, and sizes in the cultivars far exceeds that of the combined native species. Although the hybrids are a great improvement on the species for garden purposes, they have not lost the charm of simplicity which characterizes so many of our native plants.

Louisiana irises are cultivated successfully as far north as Boston, but their normal garden range should be considered the South, where they originated. They are a splendid example of native plant material which has been improved through breeding to fill a garden need of a specific area.

The group of irises which has become known as Louisiana irises includes *Iris fulva*, *I. brevicaulis*, and *I. giganticaerulea* and their hybrids. The first two species mentioned inhabit an area far beyond the boundaries of Louisiana but are found within Louisiana in greatest concentration. *I. giganticaerulea*, however, inhabits only the coastal marshes of the state from New Orleans westward to the Texas border. While a few select clones of the species have made good cultivated plants, it is their hybrids that have proved most exciting to gardeners.

In southern Louisiana, indigenous stands of the above three species are often located within bumblebee range of each other. Cross-pollination between species has occurred frequently enough to give rise to numerous populations of hybrids. Since the species are cross-fertile and their hybrids highly fertile, advanced hybrid generations are not uncommon. Most of the early garden sorts were collected natural hybrids.

Each of the species of Louisiana irises is able to maintain itself in its own special habitat while hybrid swarms that appear from time to time may disappear under stress of adverse conditions. The encroachment of civilization has depleted many of the once luxuriant stands of both hybrids and species, and in some instances has eradicated them completely.

Distinguishing the Species

Field identification of the species is not difficult. *Iris fulva* is found in the cypress-gum swamps where shallow flooding occurs during the fall, winter and spring. The flower color is, as the name indicates, a coppery-red or occasionally yellow. The flower stalk is usually 20 to 24 inches tall. All six corolla segments have a tendency to droop. This species ranges from near New Orleans as far north as Missouri.

Closely akin to *I. fulva* are the Abbeville irises. In general appearance these seem to be a robust form of *I. fulva* but usually are sufficiently larger in size to be distinguishable in the field. Their habitat is limited to a single swamp near Abbeville, Louisiana. They are of prime horticultural importance because of their ability to produce superior garden hybrids. Early hybridizers such as Dykes, E. B. Williamson, and George M. Reed did not have the benefit of this superior breeding stock. For this reason their attempts to breed worth-while garden sorts fell somewhat short of their goals. Although the Abbeville irises are well known and have contributed much to the garden cultivars of today, their taxonomic status has not yet been resolved.

Iris brevicaulis inhabits wet pastures from southern Louisiana northward to Indiana. It is distinguishable by its dwarf size and usually blue, but occasionally white, flowers which may be produced on zigzag stems. The foliage tends to be taller than the flower stalk. This upland species has exceptionally clear flower color and leathery substance. It has been used extensively by hybridizers to attain cold-hardiness, stem branching, and floriferousness in the garden hybrids. The sepals of *I. brevicaulis* tend to have a horizontal posture while the petals are more inclined to be vertical.

Iris giganticaerulea is found in the open coastal marshes where occasionally the water may become slightly brackish. This species will tolerate deeper flooding than *I. fulva*. It is indeed a giant, ranging in height from three to six feet with flowers that commonly measure more than six inches across. Its flower color is usually blue but occasionally a white form appears. *I. giganticaerulea* has been considered by some to be a variety of *I. hexagona,* which it most closely resembles.

Land drainage and the subsequent use of the land for agriculture, industry, and housing have already greatly depleted or eradicated the once great stands of Louisiana irises. To date the greatest conservation effort has been made by the iris collectors who were once severely criticized for destroying nature. From their timely efforts and the work of the hybridizers who followed, a permanent class of garden irises has been established and the danger of these plants joining the dodo has been lessened.

Culture

The cultivation of Louisiana irises in the South presents no difficulties. Ordinary garden soil containing enough organic material to hold moisture will do. In dry seasons a mulch will help retain moisture and a little watering may be necessary. Fertilizer is helpful. These irises will bloom in filtered light, but not in dense shade; full sunlight insures maximum flowering. In the South they are ideal for naturalizing at the water's edge. Water covering the rhizomes from one to four inches is ideal.

Those attempting to grow Louisiana irises in the North must be warned that their culture differs in two ways from that of bearded irises. They do not require soil drainage, and they are more susceptible to winter injury. Bog culture should not be attempted, and the plants should be covered deeply with straw or other mulch before freezing weather begins. They bloom just after bearded irises in the northern gardens.

DESIGN FOR A COLORADO NATURALISTIC GARDEN

M. Walter Pesman

GARDENS in a region of scanty rainfall are seldom designed without resorting to irrigation. Watering by hose or underground sprinkling system is considered by Colorado gardeners as a primary necessity. This does not mean that it is impossible to construct a naturalistic garden without this aid, but that we do not consider it worth while to sacrifice beauty and satisfaction to a rather empty, hypothetical concept of the original wild flower garden. If we cannot irrigate our garden, we'd rather select a different site, where we can! That is how we differ from true desert areas.

So our gardens in Denver and similar regions range all the way from the Kentucky bluegrass type to the rock garden with stone, picturesque timberline stumps and stunted evergreens, somewhat on the order of the Japanese garden. Instead of achieving a special Colorado type we recognize influences from England, Spain, Holland, California, and Arizona; they do not make us less happy.

In this article I shall give a hint of what we can uniquely produce here, profiting from our natural environment: a garden which I might define as a "man-made sample of nature at its best in the mountain mood." It must be the result of a sensitive regard for the practical requirements of its plants, for the recognition of their belonging together, and for the artistic arrangement of all the elements of design.

Because of our many types of plants (from five different plant zones), and our easily available inanimate garden materials, among which are the finest and most varied kinds of natural rock, we can here produce a garden that is unlike any other anywhere, one that has its own specific beauty.

To save space I am going to contrast a dozen of the pitfalls I have observed, together with the solution in each case. Naturally we could make a long list: I shall merely mention some common faults.

A ROCK-AND-WATER GARDEN, composed mainly of native Colorado plants.

Pesman

PITFALLS	SOLUTION
1. Because of the large choice of plant material there is a temptation to make a "plant collection," lacking unity in design.	Once the kind of naturalistic garden has been decided upon, its plant material follows its "feeling," and only appropriate plants are used.
2. A Colorado blue spruce is often among the first plants wanted. It is spectacular and cries out: "Look at me, look at me!"	A group of unequal heights fits in with a proper design. This is true for upright junipers as well. Pines are less difficult.
3. A conglomeration of various kinds of rocks is at best an interesting stone collection.	One type of attractive rock had best be the basis of your rock garden. Avoid white quartz in any case.
4. Typical cushion-type alpines are difficult to grow and hard to fit in with other plants.	Use them only where you can provide their special growth requirements.
5. Cacti and yuccas are dry-land plants, seldom suitable for rock and water gardens.	They can be attractive as indicators of desert gardens and may be all right away from lush plant growth.
6. The wrong ground surface can detract from convincing rock formations, flower borders, or shrub groups.	A sensitive observer of nature will intuitively model the ground to rock species and drooping plant forms on slopes.
7. Harsh color combinations appeal to some tastes.	Naturalistic gardens show many modulations in color, except in the tropics.
8. "Man-sized" stones are often brought in by auto, collected at random.	Dominance and subordination hold here as well as in all other design. Use some very large rocks, well placed.
9. Since snow-in-summer and periwinkle are so easily grown they are sometimes used to hide ugly corners.	Some such cultivated plants are in fact "weeds," killing out more choice types. A well-designed garden has no ugly corners.
10. Japanese lanterns and cute fishermen find their way into many wild flower gardens for some reason.	Oddities do not make a garden beautiful; good design does not require them for interest.
11. Tall evergreens and low groundcovers may leave a vacant eye-level height.	Colorado is fortunate in having a number of low evergreens and many good shrubs for wild gardens.
12. Ease of operation has tempted some gardeners to install automatic sprinkling systems, for this type of garden.	Even with careful selection it is impossibel to combine dry-land plants, alpines, and water-lovers under one general moisture regime.

Here then are some of the most frequent mistakes. Many others are well covered in various treatises on rock gardens and in articles on design. All of them have application to *any* type of wild flower gardens in *any* region: desert gardens, heath gardens, forestscapes, water gardens, and transported tropical scenes.

Landscape design, in other words, comes back to the fundamental principles of sound analysis, plant knowledge in the broadest sense, artistic sensitivity and fitness. Without any one of these our wild flower garden will be unexciting and unconvincing. With them it can furnish a new experience in gardening akin to that of communing with nature or enjoying a fine piece of art.

PLANTS FROM THE ROCKIES

M. Walter Pesman*

THE diversity of cultural requirements for plants from the Rocky Mountain region—the "Sunshine States"—has resulted in a dearth of information about their horticultural possibilities. Plants from the *Alpine* zone seldom grow successfully in the *Plains* zone: conditions of soil, rainfall, and season are very different. They might, however, be useful in far northern regions. In between these two extreme zones, ecologists generally recognize three other plant zones: the *Subalpine* or Hudsonian life zone, just below timberline, the *Montane,* or Canadian zone, the typical coniferous forest region, and the *Foothills* or Transition zone. Each has its own particular growth requirements. Plants that are accustomed to a certain climate had best be kept together if a garden of native species is to be successful. Those treated here range through all the climatic zones of the region.

We could add a great many more exquisite plants of the Rocky Mountain region; they are as desirable as many of the introductions from far countries. All they need is experimentation, to determine their secret for being "tamed" for garden culture.

Some of the trees and shrubs from the Rocky Mountain region may form the background or an occasional accent in a garden of other native American plants. The best and most adaptable of these are listed separately (see page 70). Of trees, only the coniferous evergreens are included; the deciduous sorts are more appropriate growing in the wild. There are, however, several treelike shrubs which can serve the gardener handsomely; some are an answer to a rock-gardener's prayer because of their small size (as compared with trees), their attractive form, and their adaptability under culture.

The list of choicest shrubs represents my personal preferences. It is based on appearance, availability, and hardiness. In the secondary list may be plants which would take first place with other gardeners. As a guide to their cultural needs, the climatic zone of each is given in italic initials at the end of the descriptive line.

The Choicest Shrubs from the Rockies

Cercocarpus ledifolius—curl-leaf mountain mahogany. Handsome slow-growing broadleaf evergreen for sun and alkaline soil; stands shearing. *F*

Chamaebatiaria millefolium—fernbush. For rocky places; small, aromatic, attractive. *P*

Cowania mexicana—cliff-rose. Fragrant; long blooming; needs sun. *F, P*

Fallugia paradoxa—Apache plumes. White flowers all summer; needs sun. *M*

Fendlera rupicola—desert mock-orange. For dry rocky places; white flowers, pink buds. *F*

Jamesia americana. Mock-orange relative. Woolly leaves, orange in fall; for rock crevices. *S, M, F*

Peraphyllum ramosissimum—squaw apple. Fragrant blossoms, decorative fruits; for sunny alkaline areas. *F*

Potentilla fruticosa—shrubby cinquefoil. Yellow blossoms amid gray leaves all summer. *A, S, M*

Rubus delieiosus—thimbleberry. Large white flowers, drooping habit; must have good drainage. *M, F*

A stands for Alpine zone: *S*, Subalpine; *M*, Montane; *F*, Foothills; *P*. plains.

*This is mostly a compilation, to which three persons have graciously and generously contributed. They are: **Mrs. Ruth Ashton Nelson**, author of "Plants of Rocky Mountain

Ground Covers

Several plants of the area are excellent as ground covers. Kinnikinick is the intriguing Indian name for one of the finest of them. Call it bearberry (*Arctostaphylos uva-ursi*) if you prefer. Other ground covers from the Rockies include these plants:

Antennaria parvifolia—pussytoes. Useful in rock gardens and between flagstones. *S, M, F*

A. rosea—pussytoes. Dainty, silvery, with pink flower-heads. *S, M, F*

Arctostaphylos uva-ursi—bearberry. Lustrous leaves, red berries, *M, F*

Artemisia frigida—dwarf sagebrush. Fine-leaved, silvery, and hardy. *M*

Mahonia repens—creeping mahonia. Evergreens with bronze hue in winter. *M, F, P*

Eriogonum umbellatum—sulphur-flower. Low woolly mat; yellow flower-clusters turning red in fall. *M, F*

Fragaria ovalis—mountain strawberry. Good cover even on dry spots. *M*

Linnaea borealis—twin-flower. A delicate plant, worth babying; does best on decaying wood. *S, M*

Pachistima myrsinites—mountain-lover. Substitute for boxwood in shade. *M*

Rosa arkansana and other Rocky Mountain roses. Good for erosion control. *F, P*

Sedum stenopetalum. Beautiful but hardly thick enough to cover ground. *A, S, M, F*

A stands for Alpine zone; *S*, Subalpine; *M*, Montane; *F*, Foothills; *P*, Plains.

Perennials of the Plains

The perennials and bulbs of the "Sunshine States" are generally thought of as rock-garden plants. There are two distinct types as to character and culture, the Plains and the High Altitude groups. In the lower regions the plants grow in dry situations in a soil that is often alkaline, rarely showing the slightest trace of acid. The winters are sunny. Here are some of the herbaceous plants from western plains that would be attractive in gardens:

Allium acuminatum. Reddish-purple-flowered onion. Dry sunny location.

Argemone—prickly-poppy. Large white blooms and prickly leaves.

Echinocereus species—hedgehog cactus. Magnificent orange and scarlet blooms.

Ipomoea leptophylla—bush morning-glory. Purple flowers, enormous roots.

Leucocrinum montanum. Dainty, early-flowering, white sand-lily.

Mammillaria vivipara—pincushion cactus. Pink and prickly.

Melampodium cinereum. A white "paper-flower," for dry sunny spots.

Mentzelia decapetala (and others)—evening-star. White blossoms.

Oenothera—evening-primrose. A large number, all very attractive for rock gardens.

Opuntia arborescens. Shrubby cactus with purple blossoms.

O. humifusa. A prickly-pear; yellow, pink or copper when in bloom.

Penstemon—beardtongue. Many kinds—white, pink, red, blue flowers.

Phlox andicola and *P. hoodi.* Mats of white flowers.

Sphaeralcea coccinea—cowboy's delight. Hardy, free-blooming, scarlet; silvery leaves.

Yucca baccata. Southern species with edible root.

Y. glauca. Most common of the three yuccas.

Y. harrimanniae. The dwarf, dense kind, for compact use.

Zinnia grandiflora. Yellow cushions of bloom appearing on sunny, dry plains.

National Park," now living in Colorado Springs where she grows a number of native plants; **George W. Kelly,** author of "How to have Good Gardens in the Sunshine States," a nurseryman and student of our regional horticulture for many years, of the Cottonwood Garden Shop in Littleton, Colorado, and **Harry M. Swift** of Golden, owner of Western Evergreens, where he grows native species in quantity. Information was also gleaned from the experimentation of the late Kathleen Marriage and D. M. Andrews.—M.W.P.

H. E. Stork from NAS

LITTLE RED-ELEPHANT (*Pedicularis groenlandica*). Native to wet alpine meadows. A cousin of the eastern wood betony. Also called "elephantella."

Pesman

EVENING-STAR (*Mentzelia decapetala*). Fragrant yellow to white flowers opening in evening. Propagate by seed where plants are to grow. Native to western plains.

Adaptable Wild Flowers from High Altitudes

In the mountains but below the Alpine and Subalpine zones there grows a group of plants which include some of the most reliable kinds for gardens. The pink *Phlox longifolia* and *P. multiflora* (also white or purplish) are among the best of these. Others include these attractive plants for gardens:

Calochortus gunnisoni and others—mariposa-lily. White cuplike flowers, often colorfully marked.
Lewisia rediviva—bitter-root. Pink blossoms in a rosette of leaves.
Penstemon crandalli. A four-inch mat with lovely turquoise bloom.
Pulsatilla ludoviciana—pasque-flower. Like "Swiss spring anenome," lavender.
Thermopsis divaricarpa—golden banner. Brilliant golden pea, spreading.

Alpine Plants

The alpines of the Rocky Mountain region are the most familiar plants, especially to rock-gardeners. While some of them, admittedly, have interest only for collectors and botanic gardens, there are some treasures among them.

Aquilegia caerulea and *A. saximontana* top the list in beauty. The latter is called by Mrs. Ruth Nelson, "the very best and loveliest of the alpines, and very well behaved in the garden."

Next might be *Saxifraga* (*Boykinia*) *jamesi*, with showy, rosy-pink flowers and neat foliage, growing in rock clefts.

The following are cushion plants, many of them difficult to grow at low altitudes. The alpine forget-me-not (*Eritrichium elongatum*), with its numerous sky-blue (sometimes white) flowers with yellow centers is truly unforgettable. Moss campion (*Silene acaulis*) is its pink counterpart. In white we have alpine sandwort (*Arenaria obtusiloba*); rock-jasmine (*Androsace carinata*), a fragrant, yellow-centered flower; and mountain dryad (*Dryas octopetala*); in yellow, *Geum turbinatum* (or *G. rossi*). Two of the clovers (*Trifolium dasyphyllum* and *T. nanum*) are interesting cushion plants, both widespread. Whitlow-wort (*Paronychia pulvinata*) is really a shrub, though seldom more than two inches high. It grows in dense clumps and bears many inconspicuous greenish flowers.

Many of the other alpine plants are difficult and perhaps even impossible to grow outside their native habitats. Here is a list to tempt the specialist:

Claytonia megarrhiza. A succulent rosette with a fringe of pink blossoms; high mountain tops.

Gentiana parryi, *G. thermalis* (annual) and others. All blue.

G. romanzovi—Arctic gentian. 4 in. white flower with purple-black stripe.

Lloydia serotina—alpine lily. 2 to 6 in., creamy white and pink.

Moneses uniflora—wood-nymph, *Chimaphila*—pipsissewa, and *Pyrola* species. Mountain plants of the Heath family, that have a good chance in other regions if provided with plenty of peat-moss.

Pedicularis groenlandica—elephantella. Fascinating red flowers, resembling an elephant's head; in wet meadows.

Polemonium confertum—sky-pilot. Blue; and other polemoniums.

Primula angustifolia—fairy primrose. 2 in., rose-pink.

P. parryi. Along running water, a bright rose purple.

Ranunculus adoneus—snow buttercup. At the edge of snowbanks.

Rydbergia grandiflora—old-man-of-the-mountain. Dwarf alpine sunflower, with woolly heads, solitary, over an inch in diameter.

Sedum roseum—king's crown, dark red; and *S. rhodanthum*—rose crown; both in wet places.

ARCTIC GENTIAN (*Gentiana romanzovi*), with purple-striped white flowers in August. From arctic and high alpine regions; for the alpine garden only.

Charles J. Ott from NAS

Evergreens for Landscaping

Abies concolor—white fir. Soft in aspect. Intolerant of some soils. *M, F*
Juniperus communis saxatilis (*J. c. montana*)—mountain juniper. Satisfactory prostrate form. *M, F*
J. monosperma—cherrystone juniper. Gray-green. Tolerates drought, alkalinity. *F*
J. scopulorum—Rocky Mountain juniper. Has many fine horticultural derivatives. *F, P*
J. utahensis—Utah juniper. Shrublike tree for dry, alkaline situations. *F, P*
Picea pungens—Colorado blue spruce. Beautiful, easily grown, but not always appropriate. *M, F*
Pinus aristata—bristle-cone pine. From high elevations; slow growing. *S, M*
P. edulis—pinyon pine. Small dry-land tree. Do not overwater! *F, P*
P. flexilis—limber pine. Informal and slow growing. *S, M*
P. ponderosa—ponderosa pine. Needs room, likes heat and dryness; good for bonsai. *M, F*
Pseudotsuga taxifolia—Douglas fir. Good; easy to cultivate. *S, M, F*

Treelike Shrubs of the Rockies Recommended for Gardens

Acer glabrum—shrub maple. Easily grown, neat, and useful; yellow in fall. *M, F*
A. grandidentatum—shrub maple. Difficult to move, slow-growing; brilliant fall color. *P*
Alnus tenuifolia—alder. Decorative catkins and cones. *M, F*
Betula fontinalis—birch. Small, fine-textured tree, horizontally branched. *M, F*
Chilopsis linearis—desert-willow. Showy white and purple blooms. *P*
Crataegus saligna—hawthorn. Black berries, narrow leaves, brilliant red in fall. *F*
C. succulenta. Bunches of orange berries. Good fall color. *F*
Elaeagnus commutata—shrub Russian-olive, silverberry. Silvery of foliage, flowers, fruit. *M, F*
Prunus melanocarpa and others—cherries and plums. Fine fall color. *M, F, P*
Robinia neo-mexicana—southwestern locust. Spectacular pink flowers. *F, P*
Shepherdia argentea—silver buffaloberry. Silvery leaves, red berries. *F, P*
S. canadensis. Probably not yet in trade, but of value for shade. *S, M, F*
Sorbus scopulina—shrub mountain-ash. Red foliage in fall; slow-growing. *S, M, F*

Supplementary Selection of Shrubs

Those that are native in the foothills are likely to do best in other regions. Transplanting them, however, may be difficult. Nursery grown plants will take hold better in the garden.

Amorpha canescens—leadplant, 2 ft.; purple spikes in summer. *P*
Artemisia species—sagebrush. Ornamental for their silvery color. *A, S, M, F, P*
Betula glandulosa—bog birch. A neat small shrub next to water. *A, S*
Ceanothus fendleri. 3 ft.; thorny, spreading, white bloom, difficult. *F*
Ceanothus velutinus. Glossy evergreen, fragrant white flower-clusters. *M*
Chrysothamnus species—rabbit-brush. Difficult; dry gardens; late summer bloom. *F*
Forestiera neo-mexicana. Very hardy, good, bushy; small blue berries. *M*
Holodiscus dumosus—rock spirea. Creamy-white trusses, toward pink. *M, F*
Physocarpus monogynus—dwarf ninebark. Most desirable; neat; fall color. *M, F*
Ptelea baldwini—hoptree. Larger flowered than *P. trifoliata*. *F*
Purshia tridentata—antelope-brush. Interesting half-evergreen, dry. *M, F*
Quercus gambeli, et al. Most desirable, but very difficult! *M, F*
Rhus cismontana and *R. trilobata.* Outstanding fall color, but weedy. *F*
Ribes aureum—buffalo currant; *R. cereum*—squaw currant. Both good, but not outstanding. *F, P*
Sambucus pubens—scarlet elder. Beautiful flower and fruit; rank. *P*
Salix irrorata—bluestem willow. The only neat garden willow. *F*
Symphoriearpos orcophilus. Decorative pink bloomer, desirable. *M, F*

A stands for Alpine zone; *S*, Subalpine; *M*, Montane; *F*, Foothills; *P*, Plains.

GROWTH REQUIREMENTS FOR PLANTS FROM THE ROCKIES

George W. Kelly

OUR true alpines need much precipitation but adequate drainage. Perhaps the best practical solution is an artificial "moraine" with running water underneath and rock chips plus leafmold. In general the soil should be on the acid side.

Running water is particularly needed for the royal purple *Primula parryi* and its near ecological associates, like *Saxifraga arguta* and *Cardamine cordifolia*, as well as for the choice *Ranunculus adoneus*, that likes ice-water.

Moneses, *Chimaphila* and *Pyrola*, like *Linnaea*, are forest plants; they need shade and peaty ground.

Claytonia megarrhiza, *Lloydia serotina*, *Gentiana romanzovi*, *Eritrichium elongatum* and *Polemonium confertum* are in full high-altitude sun. So is *Rydbergia grandiflora*.

Quite different growth conditions are needed for the Plains perennials and bulbs. They are almost invariably high pH plants, and a number grow in clay soil, or shale; *Mentzelia decapetala* is almost confined to Niobrara shale. Most of our cacti prefer heavy soil, full sun and scanty rainfall. *Argemone*, *Ipomoea leptophylla*, *Sphaeralcea Zinnia* (*Crassina*) and *Melampodium* fall in the same category. Some of them have extensive and/or deep roots that take care of the water supply during dry spells. Most yuccas like good drainage.

A friend in the Northwest suggested that she was going to install special plastic umbrellas and actinic rays for her Rocky Mountain plants. Well, she might do worse!

ALPINE SPRING BEAUTY (*Claytonia megarrhiza*). This spring beauty of the West has a ring of pink flowers around a rosette of succulent leaves. It is found in the high mountains, above timberline.

Pesman

NATIVE PLANTS IN GARDENS OF THE ARID WEST

Adaptive planting glorifies nature rather than trying to conquer it

Ralph D. Cornell

In the arid regions of the West we have all climatic zones, from subtropical to alpine. Habitats of the xerophytic plants growing in them range from the shoreline of the Pacific to the deserts of high mountain elevations. Plants that grow naturally in one place cannot necessarily be made to grow in another. To suggest a broad selection of dry-land plants for this region is therefore not practical. It is only the basic thinking as to the choice and use of suitable kinds that can be presented.—R. D. C.

THE "Arid West" covers a lot of territory, both literally and figuratively. For this brief article, however, we shall assume that it extends from the Rocky Mountains to the Coast Range, albeit other portions of our country get most almighty arid in a hot, dry summer.

The arid West we speak of is truly the "Land of Little Rain." Remarks about it would apply equally to other locales where natural plant growth must struggle against extreme temperatures, drying winds, intense summer heat, little or no rainfall, and soils usually deficient in humus but overstocked with alkalies. No respectable plant could survive under conditions of such extreme aridity, unless it had become adjusted and adapted to that type of environment through the long, slow processes of evolution. So, it is to the native plants of this arid region that this brief comment is dedicated.

When our pioneering fathers moved westward it was to "conquer the land." They destroyed and subdued as they went forward, to convert a lovely primitive world into what they called civilization. This brought with it those things made familiar by their backgrounds, good or bad, right or wrong—as is the way of man.

Cultural amenities come slowly in social progress. They must await their turn in the cultural unfolding of a society. So the early western gardens only reflect the background of those who planted them. They were meager gardens at best, partly because they did not consider the climate. The desert homesteads did not "bloom as the rose," in their beginnings. Lawns were difficult to establish and maintain; peonies refused to grow at all; the old familiar plants of the eastern seaboard and Europe could not adjust to the arid conditions of the West.

It has taken the better part of a century for the American pioneer, moving in from the East, to adjust his thinking to the obvious facts that gardens are apt to be successful only if they use plants which are adjusted to the local growing conditions. This idea of adaptive planting is now coming to the fore to influence gardens of today. It is a good garden practice to "live with" the soil and the climate rather than defy it to do its worst. We are beginning to see front yards and attractive gardens designed without green lawns: planted without the exotic temperate-zone plants that demand humidity and cool weather; adapted to the conditions under which they must live, if they are to live at all.

Native plants of the arid regions survive there only because their specialized structure and metabolism make it possible

All photographs by the author

DESERT PLANTS are combined effectively in this garden in Palm Springs, California. Included are several kinds of YUCCA, OPUNTIA, AGAVE, and the COACH-WHIP or OCOTILLO (*Fouquieria splendens*).

for them to meet the special growing conditions of the desert. They fall roughly into categories, one of which must have "wet feet" and abundant moisture but which, given that condition, will endure extremes of high atmospheric heat and aridity. This type of plant occurs along stream beds, water seeps or places where its roots can reach water. Such plants, more or less common throughout the arid West, would include all varieties of cottonwoods (*Populus*), willows (*Salix*), sycamores (*Platanus*), hackberries (*Celtis*), and others that are common to wet places. In warmer sections of the Southwest it would be possible to add to the "wet-feet" brigade the common mesquite (*Prosopis*), also the desert-willow (*Chilopsis*), the Washingtonia fan palm and many others, each species with a varying thirst for water or toleration of drought. Because these types are adjusted to adequate ground water, they are among the easiest varieties to transplant into the garden where irrigation is available to assure their water supply.

A second category of native plants for arid conditions would include both woody plants and succulents that have developed extensive surface-root systems in an intricate pattern of webbing that awaits the slightest shower. They are quick to absorb even superficial rain for storage within their tissues. Quick acquisition and slow relinquishment of moisture is the *tour de force* which enables them to survive long periods without rain. Such seems to be the adaptation of the cacti and

CLIFF ROSE (*Cowania stansburiana*) can be grown in desert gardens of the West. Flowers are white with a mass of yellow stamens.

other succulents; of such woody plants as the creosote-bush (*Larrea divaricata*), which is one of the most widely distributed woody shrubs of the Southwest; the bladder-pod (*Isomeris*), the rabbit-brush (*Chrysothamnus*) and so on. These might be thought of as the conservatives, for they take a middle-of-the-road policy, absorb all the water possible during wet moments, and relinquish it slowly, with reluctance. Plants of this nature, such as the Joshua tree (*Yucca brevifolia*) and the saguaro cactus (*Carnegiea gigantea*), actually expand measurably in girth after a rain, and then gradually shrink back to lesser proportions as the stored water is consumed by the plant. Such plants are suitable candidates for the garden but are harder to establish because of the general tendency of gardeners to over-water. They do well if properly handled.

Other methods of plant adjustment to aridity (in the course of evolution) include production of thorns and spines, which give protection against browsing; leaves and sap that are bitter to the taste of animals; leathery textures, hairy surfaces, resinous coatings and other devices that check moisture loss and discourage molestation. Many desert plants shed their leaves during the hottest weather. Some produce leaves only after a rain and then quickly drop them when they

CALIFORNIA TREE-POPPY (*Dendromecon rigidum*), with bright, evergreen foliage, withstands heat, drought and considerable cold. When not overwatered it is adaptable to gardens.

have consumed the transient moisture deposited by a sudden cloudburst or passing shower. Some of the woody plants are practically leafless, or bear inconspicuous leaves for only short periods—such as the cacti. Their stems have green "bark" in which occurs the chlorophyll, functioning as it does in the leaves of ordinary plants. The ways and means of nature are marvelous and if man ever is to be in tune with the world about him, he must attempt to understand it.

Growing these native plant children of the arid wastes in gardens is not as simple as it sounds because man seldom provides the same conditions that are found where they grow naturally. Soils and climate may be different, moisture supply may vary from their normal, and all too frequently they are planted too close together. Then there is the further hazard of garden pests. If a plant can withstand all this, it is worth its weight in gold, in any garden. The use of native plants is a good idea when it works.

Perhaps of even more importance than the actual plant varieties in the garden is that of layout, and the method of using them. Gardens can be pleasing, functional and attractive without expanses of green lawn: without simulating a prairie or other natural landscape; without reflecting trends of other eras and distant places. The bare earth of a swept courtyard or the paved texture of a patio floor takes on a particular significance in hot, dry countries and can be very attractive as part of a design pattern in which the play of light and shadow on interesting surface textures is thoughtfully sought. Garden shade against hot sunlight is pleasant. The sound of water, a seat 'midst the coolth of a planting, may be significant in garden design.

The tendency to design desert gardens for desert settings has developed surprisingly in recent years, frequently with much sympathetic understanding of the use of xerophytic plants. Some results are satisfying and show an ingenious

Mission of San Xavier del Bac near Tucson, Arizona, where saguaro cactus (*Carnegica gigantea*), century-plant (*Agave americana*) and ocotillo are being successfully grown. All were moved in from surrounding desert areas.

blending of ideas and materials, merging the natural desert and the sown. Ground surfaces textured by colored pebbles or gravel may serve in lieu of conventional ground covers. Rock forms and desert plants are brought into the design from surrounding acres. Lawn grass is used sparingly, if at all, and then for contrast and color value. The plan is designed for efficiency in both use and upkeep under the limitations of an arid climate.

This type of home landscape has burst the shackles of tradition. It expresses a way of life that recognizes the new era in garden design—one which stems from the proper recognition of the climatic demands of a region. Plants, like people, must live in harmony with their environment, not fight it. We have emerged from the pioneer era into one which glorifies nature rather than attempting to conquer it.

CALIFORNIA NATIVE PLANTS SUITABLE FOR GARDEN CULTIVATION

Percy C. Everett

FLORISTICALLY speaking, California is best known for its colorful displays of spring wild flowers. From the days of the early explorers, to whom our land seemed to be on fire from the masses of California-poppies blanketing the hillsides, the wild flowers of California have been one of our greatest spring attractions.

Many are annuals that have been in cultivation for many years. The California-poppy (*Eschscholzia californica*), which may be annual or perennial, is known the world over. However, it is not generally known that other beautiful species of *Eschscholzia* are useful in gardens, among which are *E. lobbi,* a delightful brilliant yellow small-flowered plant suitable for rock gardens, and *E. caespitosa,* a slightly taller species with orange flowers.

The godetias, clarkias and gilias have all played their part in the horticultural world for many years. Particularly handsome is *Godetia whitneyi,* its large blossoms having deep splotches of red edged with shading white. (Botanically, the genus *Godetia* has been transferred to *Clarkia.*) Less well known are *G. bottae,* a low spreading plant surmounted by hundreds of clear pink flowers, and *G. biloba,* a dainty two-foot plant with deeply cut pink flowers that prefers dry, well drained situations. *Clarkia elegans* was introduced to European gardens about 1832 by David Douglas, and from it have stemmed many horticultural varieties.

Of the gilias, the best known is *Gilia achilleaefolia,* a blue-flowered plant that is attractive in April and May. The many white-to-blue variations of *G. capitata* and the three-colored pattern of *G. tricolor,* called bird's-eye gilia, make these two species popular. (Some gilias are commonly known as *Linanthus.*) These and others are easily grown and entirely suitable for both the native-type and the more formal garden in the West.

There are many others, too, such as several species of *Coreopsis,* owl's-clover (*Orthocarpus*), Turk's-rugs (*Chorizanthe*), lupines, particularly *Lupinus nanus,* two *Nemophila* species, baby-blue-eyes (*N. menziesi*) and five-spot (*N. maculata*), and species of *Phacelia,* including the California-bluebell (*P. minor*). The sand-verbena (*Abronia*) is a perennial treated as an annual.

Native biennials (some with perennial relatives or propensities) include the desert-marigold (*Baileya multiradiata*), the blazing-stars (*Mentzelia*), and the many handsome evening-primroses (*Oenothera*) of the West.

ECHEVERIA PULVERULENTA, a western succulent with red flowers that is worthy of cultivation in rock gardens; propagated from offsets.

Rancho Santa Ana Botanic Garden

Among California perennials, the most commonly grown are beach and mountain strawberries (*Fragaria chiloensis* and *F. californica*), both used as ground covers, and several species each of *Iris* and *Penstemon*. Other useful native perennials for the garden include columbine, wild ginger, sea-dahlia, monkey-flower, coast sagebrush, California-fuchsia, heuchera, and matilija-poppy.

A number of species of Pacific Coast iris have found their way into horticulture. Briefly, these are the best known:

Iris douglasiana—redwood iris; most adaptable.

I. innominata—northern; dwarf; variable in color.

I. munzi—flowers of true sky blue.

All these are used in hybridizing.

California has been particularly blessed with *Penstemon* species, and many gardeners grow them successfully by giving them exceptionally well-drained soils and a minimum of water. The blue bedder (*P. heterophyllus* var. *purdyi*), with low spreading growth and masses of rich blue flowers, has been most widely used. One, *P. palmeri,* is fragrant. Several are appropriate for rock gardens, where they provide brilliant color.

Bulbous materials are best represented by the Lily and Amaryllis families. Many species offer a rewarding challenge to gardeners. In the lily group the best known are the true lilies (*Lilium*) and the mariposa-lilies (*Calochortus*), loveliest of all the family. Mostly the mariposa is for the specialist; the techniques of its culture are not easy to master.

Lilium parryi, with fragrant, lemon-yellow flowers, is one of the most delightful of the true lilies. It is found in scattered springy places in some of the southern California mountains, and therefore requires a very wet soil. *L. humboldti,* which has been the parent of many notable hybrids, grows naturally under oaks or in other protected semi-humus areas, where it produces large maroon, orange-dotted flowers in June and July. *L. pardalinum,* smaller-flowered, can be cultivated easily in moist soil.

Although some specialists grow the fawn-lilies (*Erythronium*) successfully, none of the species adapts itself readily to western gardens. The fritillarias, also, are better known elsewhere than in the West.

SEASIDE DAISY (*Erigeron glaucus*). There are many different species of *Erigeron*. The flowers of this particular California native are bright violet in color.

In the Amaryllis family the principal group consists of *Brodiaea* and some of its close relatives, with *Allium,* the ornamental onions, next in favor. Preferred situations for the brodiaeas are undisturbed clay soils where summer heat bakes the earth while the bulbs are establishing themselves.

Numerous California native shrubs have been cultivated in gardens during the past century. It is difficult to know where to draw the line in enumerating desirable kinds. Only a few can be mentioned here, and these are being listed with their special uses or their aspect.

Manzanita (*Arctostaphylos*)

A. uva-ursi, A. edmundsi—ground covers.

A. pumila, A. hookeri—low-growing plants.

A. manzanita, A. insularis—tall; red bark.

GILIA MONTANA is commonly known as *Linanthus*. White blossoms in spring on dry hillsides, and in many western gardens.

California-lilac (*Ceanothus*)

C. griseus var. *horizontalis*—most in demand.

Many selections and hybrids also popular.

Mahonia and Barberry (*Berberis*)

M. aquifolium—Oregon-grape; blue berries.

B. piperiana—preferred in California.

B. nevini, B. amplectens—gray-leaved.

Shrubs for special uses

Baccharis pilularis—coyote-brush; ground cover.

Calycanthus occidentalis—western spicebush; specimen.

Carpenteria californica—tree-anemone; accent in semi-shade.

Cercis occidentalis—western redbud; background or specimen.

Eriogonum giganteum—St. Catherine's lace; arrangements.

E. arborescens—tree-buckwheat; filler.

Garrya elliptica—silk-tassel bush; background.

Heteromeles arbutifolia—Christmas-berry, toyon, or California-holly; autumn fruits.

Myrica californica—wax-myrtle; hedge.

There are also the tree lupines, large five- to eight-foot shrubs massed with long stemmed inflorescenses of tight clusters of deep blue and white flowers; the magnificent fremontia, graced with a covering cloth of gold; or the spire-like ocotillo, stranger from the desert, often used for living fences. And we must not forget the widely planted sugar-bush, *Rhus ovata*. These and many others grace our valleys, hills and mountains. We have but to choose!*

*Some may wonder why certain plants have not been mentioned; to this it can only be said that selection was determined principally by space available for this article and not by lack of suitable subjects. The reader can determine by searching the literature whether or not most of the aforementioned plants can be used in other climatic zones. My information is based entirely on their culture in California. We do know, however, that many are being grown widely in this hemisphere and in England and other European countries.

SOME TIPS ON GROWING CALIFORNIA NATIVES

CALIFORNIA plants have evolved around a schedule of a winter rainy season following a long period without moisture. The watering of native plants under cultivation should therefore be handled with this fact in mind. Plantings should not be made where excess water will be received, particularly from lawn sprinklers. Within California this is particularly important, because the soils contain noxious root fungi that grow during the warm months if moisture is present. While some of the plants will accept boggy or heavy soils (preferably neutral), the majority of the native species do better in the drier, lighter, well-drained soils. A number, however, seem to have inherent tolerances to unnatural conditions. These can be grown in many types of climatic and soil zones. But for assurance of success with California plants—or any others—good drainage and care in watering should be accompanied by a knowledge of the natural habitat of the plant—climate, soil, moisture, altitude and related ecological factors.

A PACIFIC NORTHWEST WILD GARDEN

Its flowers and their seasons of bloom

Margaret McKenny

A SPRING garden is the most satisfactory wild garden in the Pacific Northwest. We have in this area two sections, one the thick shade of the Douglas-fir forests, and the other the open park-like or prairie areas where the soil is light and rocky. The flowers of the woodland areas take more readily to transplanting than those which require light soil and sunlight.

If one is fortunate enough to have a bit of untouched woodland near one's home, this is the place for the most rewarding wild garden. If a brook flows through the property, the black, fertile soil near its margin will be of advantage. Here grows the yellow skunk-cabbage, one of our first spring wild flowers. This is *Lysichitum americanum*. In contrast to the somber browns and purples of the eastern plant, our western cousin has a large, erect spathe of clear buttercup yellow.

In February the Indian plum (*Osmaronia cerasiformis*) starts to bloom and for weeks it is draped in white lace until the coming of the pale yellowish green leaves. Another early shrub is the Indian currant (*Ribes sanguineum*); its rose-purple racemes are the signal for the whirring flight of the hummingbird. Appearing even in January is the spring queen, also known as grouse-flower (*Synthyris rotundifolia*). The small lavender flowers, each set with two purple stamens, are found on the edge of the prairies, but take kindly to the moister woodland soil.

Then starring the shadows of the forest is our western trillium (*Trillium ovatum*), similar to the eastern *T. grandiflorum* but exquisitely fragrant. It unfolds a pure white, but after fertilization it passes through shades of rose to deep purple. Another native trillium is *T. chloropetalum*, interesting because of its large mottled leaves, but having small greenish-white flowers set without stalk in the whorl of foliage.

Closely following the trillium is the dogtooth-violet or fawn-lily (*Erythronium giganteum*). Though often found in

YELLOW SKUNK-CABBAGE (*Lysichitum americanum*) shows its flowers in western swamps in early spring.

H. W. Rickett

the rocky soil at the edge of the open prairies, this plant luxuriates in the wild garden, spreading from the bulblike roots and also increasing rapidly from seed. The creamy-white blooms are from one to five on the stalk and are set high above the widespread green leaves, mottled like the sides of a fawn.

Other plants of the Lily family, growing naturally in my garden are the wild lily-of-the-valley (*Maianthemum bifolium*), great clumps of Solomon's-plume (*Smilacina amplexicaulis*), the more delicate starry Solomon's-plume (*Smilacina stellata*), and the twisted-stalk (*Streptopus amplexifolius*). Others are the two fairy-bells, *Disporum oreganum* and *D. smithi*. Later comes the western camas, *Camassia quamash*. The sky-blue blossoms of this plant paint the prairies for many acres. Its bulbs furnished the principal source of starch for the Indians.

In May the western iris (*Iris tenax*) comes into bloom in shades of lavender and purple, also a few in white which is considered merely a color variation. W. R. Dykes in "The Genus Iris" points out that this species is easy to grow from seed, and deserves to be more widely cultivated. At the same time the western columbine (*Aquilegia formosa*) blooms, also *Mertensia paniculata* var. *platyphylla*. The latter was transplanted from sandy soil near a river, but has made itself so at home by seeding that half the garden is dominated by its airy blue bells, each cluster tipped by pink buds. It is a smaller, more refined edition of the eastern *Mertensia virginica*. At this time rise the strange dark drooping blooms of mission-bells (*Fritillaria lanceolata*), and the rosy-purple of the shooting-stars (*Dodecatheon hendersoni*). Back of these lies a mossy log draped with twin-flower (*Linnaea borealis* var. *americana*), whose tiny bells fill the air with fragrance.

All along the edges of the woodland grow masses of bleeding-heart (*Dicentra formosa*), with an occasional cluster of the albino form, much like the eastern Dutchman's-breeches. In the deeper

Roche

OREGON-GRAPE (*Mahonia aquifolium*) thrives in its northwestern home; it is also a favorite shrub from coast to coast.

shade grows corydalis (*Corydalis scouleri*), its foliage resembling bleeding-heart, but two feet high. Other ground covers are wild ginger (*Asarum caudatum*), an evergreen; wood-sorrel (*Oxalis oregana*), inside-out flower (*Vancouveria hexandra*), and vanilla-leaf (*Achlys triphylla*). I also have numerous violets, among them the purple prairie violet (*Viola adunea*), which will bloom in light soil in not too heavy shade.

The ferns which form the background of my garden are the sword fern (*Polystichum munitum*), maidenhair (*Adiantum pedatum* var. *aleuticum*), evergreen wood fern (*Dryopteris dilatatum*), deer fern (*Struthiopteris spicant*), and lady fern (*Athyrium filix-femina*).

Shrubs which thrive beneath the trees are salmon-berry (*Rubus spectabilis*), thimble-berry (*R. parviflorus*), ocean-spray (*Holodiscus discolor*), Oregon-grape, (*Mahonia*—or *Berberis*—*aquifolium* var. *nervosa*), syringa or mock-orange, (*Philadelphus lewisi*), hazelnut (*Corylus californica*), and our state flower, *Rhododendron macrophyllum*.

A CENTRAL WASHINGTON WILD GARDEN

Leota Kisor

IN central Washington, at the southern tip of Lake Chelan, where the Columbia River rises, close to a hundred native species of plants are thriving in my wild garden. Here is a list of them by families, with their needs or native habitat as a guide to their culture.

BORAGE FAMILY

Hound's-tongue—*Cynoglossum grande.* Garden soil.

BUTTERCUP FAMILY

White clematis—*Clematis ligusticifolia.* Ordinary soil. Nicer if watered.

Blue clematis—*Clematis columbiana.* Woods soil, not too much water.

Columbine—*Aquilegia formosa.* Good garden soil, water.

Wild peony—*Paconia browni.* Garden soil; keep damp.

Baneberry—*Actaea spicata arguta.* Garden soil, leaf-mold; keep damp.

False bugbane—*Trautvetteria grandis.* Moist mountain woods along stream banks.

Low blue larkspur—*Delphinium menziesi.* Common field flower usually not included in wild garden.

DOGWOOD FAMILY

Bunchberry or creeping dogwood—*Cornus canadensis.* Garden soil with leaf-mold. Keep damp.

Pacific dogwood—*Cornus nuttalli.* Some shade, good soil and water.

FIGWORT FAMILY

Beardtongue—*Penstemon species.* Gritty soil, perfect drainage, little water.

Monkey-flower — *Mimulus* species. Garden soil but must be kept wet.

GENTIAN FAMILY

Northern blue gentian—probably *Gentiana acuta.* High mountain areas.

HONEYSUCKLE FAMILY

Twin-flower—*Linnaea borealis.* Rich soil with leaf-mold. Water often.

Snowberry—*Symphoricarpos albus.* Garden soil. Gets very large when watered often.

Blue-berried elder—*Sambucus glauca.* Garden soil; manure for quick growth.

IRIS FAMILY

Iris missouriensis. Wet spots in sagebrush zone.

I. tenax—Garden soil.

Grass-widows—*Sisyrinchium inflatum.* Rocky hillsides near water.

S. (Olsynium) grandiflorum. Garden soil.

LILY FAMILY

Mission-bells or chocolate-lily—*Fritillaria lanceolata.* Garden soil.

Yellow-bells—*Fritillaria pudica.* Garden soil.

Yellow glacier-lily or dogtooth-violet—*Erythronium parviflorum.* Garden soil, leaf-mold. Improves with cultivation.

Western trillium—*Trillium ovatum.* Good soil with leaf-mold; water.

Trillium petiolatum (*T. rotundifolium*), Garden soil, leaf-mold, water.

Bronze-bells—*Stenanthium occidentale.* Leaf-mold and abundant water.

Bead-lily or Queen's-cup—*Clintonia uniflora.* Rich leaf-mold soil, keep damp. (I have it interplanted with twin-flower.)

Fairy-bells—*Disporum* species. Rich, moist garden soil.

Twisted-stalk — *Streptopus amplexifolius.* Garden soil, leaf-mold, water.

White hellebore—*Veratrum californicum.* Good soil, water.

False Solomon's-seal or Solomon's plume—*Smilacina amplexicaulis.* Grows on dry woodsides but gets larger with water.

Star-flowered Solomon's-seal — *Smilacina stellata.* Garden soil, leaf-mold. Gets larger in wild garden with water.

Purple smilacina. Delicate and rare. Grows well in leaf-mold, damp soil.

Wild lily-of-the-valley—*Maianthemum unifolium.* Leaf-mold and plenty of water. (I use as ground cover around cypripediums.)

Camas—*Camassia quamash.* Garden soil and water. Gets larger with cultivation.

Wild tiger lily—*Lilium columbianum,* also *L. parviflorum.* Garden soil.

Green-banded mariposa-lily — *Calochortus macrocarpus.* Dry hillsides. Does well in garden soil in FULL SUN.

Cat's-ears—*Calochortus elegans.* Dry flats, low hills. *C. bakeri,* hills, pine woods.

Large-flowered brodiaea or Indian hyacinth —*Brodiaea grandiflora.* Fields, open woods, grassy slopes.

Bi-colored brodiaea—*Brodiaea bicolor.* Dry fields, plains of sagebrush and yellow pine.

Wild onions—*Allium cernuum* and *A. attenuifolium.* Damp meadows along roadsides.

ORCHID FAMILY

Chatterbox—*Epipactis gigantea.* Leaf-mold, abundant water and shade. (Rare; should be protected.)

Hooded ladies-tresses — *Spiranthes* (*Ibidium*) *romanzoffianum.* Stream banks, swamps. (Rare.)

Rattlesnake-plantain — *Goodyera* (*Peramium*) *decipiens.* Leaf-mold; keep damp.

White bog orchid—*Habenaria dilatata.* Damp ground. Transplant in clump of own soil and keep wet. (Fragrant.)

Green-flowered bog orchid — *Limnorchis stricta.* Plant in clump of own soil and give water all the time (Fragrant.)

Deer-head orchid, false lady's-slipper or fairy slipper—*Calypso bulbosa.* Not recommended for wild gardens as almost impossible to transplant.

Mountain lady's-slipper—*Cypripedium montanum.* Leaf-mold, peat-moss (we use manure, too); water generously. Partial shade. (Grows well for me.)

TWIN-FLOWER (*Linnaea borealis*) is a delicate creeping plant, native in cool mountain woods. Requires moist woodsy soil.

H. E. Stork from NAS

Yellow lady's-slipper—*Cypripedium parviflorum.* Leaf-mold and rotted manure (Rare.)

Clustered lady's-slipper—*Cypripedium fasciculatum.* Leaf-mold, some water.

PHLOX FAMILY

Jacob's-ladder—*Polemonium richardsoni* (*P. humile*). Garden soil, easily grown.

Phlox douglasi. Tap-root makes it hard to transplant. Take small plants, have perfect drainage, use little water.

Phlox longifolia. Easier than others to transplant. Wants more water.

Scarlet gilia or red star—*Gilia aggregata.* Dry banks, low hills.

PRIMROSE FAMILY

Shooting-stars—*Dodecatheon* species. All do better with abundant water.

Douglasia. Long tap-root makes it difficult to transplant. Must have perfect drainage.

PURSLANE FAMILY

Bitter-root and others—*Lewisia* species. Gravelly soil, good drainage, full sun.

ROSE FAMILY

Black hawthorn—*Crataegus douglasi.* Garden soil.

Service-berry or saskatoon — *Amelanchier florida* var. *cusicki.* Garden soil. Take small plants as hard to get out of rocky soil.

Ocean spray or arrow-wood—*Holodiscus discolor.* Garden soil.

Ninebark—*Physocarpus capitatus.* Garden soil.

Goat's-beard—*Aruncus sylvester.* Garden soil and leaf-mold; keep moist.

Nutka rose—*Rosa nutkana.* Garden soil; gets large with water.

Shrubby cinquefoil—*Potentilla fruticosa.* Garden soil; keep moist.

Choke cherry—*Prunus demissa.* Any dry soil.

Mountain-ash—*Sorbus* (*Pyrus*) *sitchensis.* Garden soil. Birds like it.

SAXIFRAGE FAMILY

Woodland-star or baby faces—*Tellima parviflora.* Garden soil.

Foam-flower—*Tiarella unifoliata.* Garden soil, leaf-mold, water.

Mock-orange—*Philadelphus lewisi.* Garden soil, water.

Grass-of-Parnassus — *Parnassia fimbriata.* Leaf-mold, water.

Fragrant golden currant—*Ribes aureum.* Garden soil.

Gummy gooseberry—*Ribes lobbi.* Garden soil.

STAFFTREE FAMILY

Mountain-lover or false box—*Pachistima myrsinites.* Dry sandy soil well drained; likes water.

WILD FLOWERS OF SOUTH DAKOTA AND ITS ENVIRONS

Spring to Fall the dry prairies put forth
brilliant flowers that are adaptable to gardens

Claude A. Barr

Photographs of wild plants by the author

EVENING-PRIMROSE (*Oenothera caespitosa*). The saucer-like blossoms are generally white or pink. Grows in gardens from South Dakota southward to Texas. Requires full sun.

WHETHER along the interminable miles of roadside or back in remote fastnesses visited only now and then by cowboys or intrepid explorers in search of the beauties and rarities of nature, the flowering plants of the Plains thrive and bloom.

Nature herself, in shaping the Great Plains, has provided much rugged terrain, many exposures of rock subsoil, remnants of silt and gravel from ancient stream courses, and wide expanses of clay and sand hills that support sparse grass cover suitable only for pasture. Yet there are many genera and hundreds of species of flowering plants that find happy footing.

I want you to visit a natural garden where some twenty years ago an acre or two were stripped of grass and soil, uncovering gravel and silt which were excavated to a depth of a few feet for road material. It is approached over level pasture land bordered closely by steep, gravelly slopes. A few flowers are to be seen as we go along, but there is nothing to prepare one for the seasonal riots of color and multiplicity of species in the abandoned pit. How so many kinds could assemble in a few years and thrive in the seemingly sterile subsoil and gravel, is a marvel. The wind, and birds and other animals, have contributed seed, no doubt, all probably from nearby unsuspected hideouts.

Outstanding in numbers and bordering on the spectacular is the June-blooming "purple" loco (*Oxytropis lamberti*), silvery green in leafage at the ground, with upborne plumes of pea blossoms, reddish

FLOWERS of *Dalea aurea* open yellow from somewhat silvery buds.

lavender to red-purple and sometimes a red as fine as any handsome red rose. Second in numbers and dominant in its season is *Sideranthus spinulosus,* a 4-inch plant, diffusely branched, fine foliaged, slightly gray, a mass of golden asters in September. The button-snakeroot or blazing-star (*Liatris punctata*) with its foot-high spikes of fine clear purple is prominent in August. A midwestern goldenrod (*Solidago glaberrima*) has established a colony with nodding pyramids of bloom. *Astragalus goniatus,* a 4-inch, pinnate-leaved ground cover of deep green, displays its lovely lavender and purple bonnets for many weeks, June and later. *Gutierrezia sarothra,* a fine-textured bright green dome, turns to a smooth mound of minute glowing gold asters in September. *Dalea enneandra* on tall slender stems, daintily foliaged, spreads its somewhat umbrella-like racemes of silver and white pea-like flowers in July and remains effective for many weeks.

All are good garden plants and have been grown in numerous gardens far beyond the Plains. Their preemption of this space where grasses have made but little headway is a hint as to their culture. The soil is as lean as could be contrived except for a few mineral elements, lime being much in evidence as encrustation on the gravel. There is little or no humus. Drainage is perhaps excessive. Obviously the plants thrive only when moisture is adequate; their moisture-conserving "equipment" must often be called into play.

A score of other worthy plants dwell in the pit or on the stripping dumps about it. The herbaceous artemisia, *A. frigida,* always charms with its daintiness, silveriness and fragrance though its bloom is readily overlooked. *Viola nuttalli,* brilliant gold, makes a great show for its size all through the moist weeks of spring. The sand-lily (*Leucocrinum montanum*), which grows to perfection in anything but pure sand, bears its waxy white six-pointed stars from the ground and gives out a fine fragrance. The full-lobed white *Phlox andicola* had lived close to the pit and had no farther to travel than its exploding capsules could throw their seed. *Polygala alba,* 6 to 8 inches high, bears a dainty lady-finger type of blossom. It frequents the slopes in clay loam. *Penstemon albidus,* white, and *P. eriantherus,* warm lavender, are here. So much for my excavated gravel pit.

The above-named and all other flowers at home on the Great Plains either complete their cycles of growth in the moist early season or have built-in mechanisms of adaptation to the drier seasons. Low rainfall is the rule. Altitudes run from 1800 feet to 6000 or more. Much wind and sun, rapid drying, drought in practically every year, cool nights (usually), and intense winter cold are to be expected. Whether far up in Saskatchewan and Alberta or at the southern escarpment in the Texas Panhandle, all Great Plains plants are endowed with cold hardiness. Types with large, deep or fleshy water-storing roots are common. Other characteristics include thick, wax-coated, light-reflecting and hairy leaves, light-avoiding leaves such as the more or less skeletonized ones, or even leaflessness as in the cacti. Relatively thick stems and stemlessness play their parts.

A growth habit that is well adapted to the region may be observed in many different genera. It is the repeatedly short

branching crown, at ground level (or apparently below ground when wind and rain-spatter have added soil), above a branching taproot. It results in the low mound or "bun" type of plant. This growth habit presents a strong defense against wind, is largely self-shading, and only partially exposed to drying air. Most plants of "bun" type cover themselves with blossom and maintain an attractive, neat appearance when out of bloom. They are ideal subjects for rock gardens, and are readily transplanted when young (virtually impossible when old and woody).

Other species sidestep the difficult seasons of the year by flowering early, ripening seed and going completely dormant, to leave their places bare. Yet some of these long sleepers have been rated by discriminating gardeners as "perfect" plants. One, *Dodecatheon pulchellum,* must stand high on everyone's list. It is the most drought adapted of the shooting-stars and, in its yellows and purples, the most brilliantly colored. *Mertensia lanceolata* is a dwarf many-stemmed bluebell with ten weeks of bloom. *Delphinium menziesi* carries on a 12-inch plant rather large stars that are velvety, and light to deep blue or purple in color. *Leucocrinum montanum* puts up as many as forty of its lovely little lilies in April and May. A host of others, *Anemone caroliniana,* charming in every aspect, white, pink, blue; *Erigeron glabellus* (*E. asper*), with dense shaggy fringes of lavender about its golden disks; *Lathyrus ornatus, L. incanus,* alike in garden effect, large flowered, purple-rose to pink in banner, wings white to pink; *Lewisia rediviva* with its many-petaled saucers of pink.

Then there are the little prairie stars (*Lithophragma parviflora*) flaunting freely their slashed blooms of purest white for many weeks; *Nothocalais* and *Ptilocalais* (*Agoseris*) suggesting dandelions but refined, well behaved and lovable; yellow *Viola nuttalli* and *V. vallicola;* and numerous bulbs, *Allium, Calochortus, Nemastylis* and others which can be grown if suitable provision is made against unsuitable moisture.

Beard-tongue (*Penstemon albidus*) whose white flowers are marked with purple lines. There are many different penstemons on the Western Plains.

Another admirable group flowers early, produces the seed crop, then proceeds to maintain nearly or completely evergreen mounds or mats of foliage. Many kinds could be named here.

What is there for July and August? Whatever the heat, with any moisture at all, there is no dearth of beautiful bloom. Very notable is the prickly-poppy (*Argemone intermedia*), its 4-inch, six-petaled flowers of crinkled white silk thrillingly fresh through the most blistering of days. *Verbena bipinnatifida* with its low mats of light purple at the roadside slows all but the most blasé of speedsters. It flowers from May to frost. The large bush morning-glory (*Ipomoea leptophylla*), purple-pink, red-throated, and the

large spreading bush four-o'clock (*Mirabilis multiflora*), pink-purple to red-purple, are consistent performers. Numerous evening-primroses (*Oenothera*), white, yellow and pink, contribute freely to the midsummer picture. Golden-aster (*Chrysopsis villosa*), begins its display of fine color. *Aster meritus* in pinkish violet with broad masses of bloom at 10 inches and *Aster conspicuus,* more pink, with broad corymbs at two feet, both from the Black Hills, are faithful in the hot months in the garden. A diminutive milkweed (*Asclepias pumila*), white or pinkish, poppy-mallow (*Callirhoë involucrata*), with its arresting show of glossy wine-red cups, and western harebell (*Campanula petiolata*), lavender-blue to deep purple, are valued for these days. *Liatris ligulistylis* with large heads of fine purple comes in July, before *L. punctata.* The daleas—*D. aurea* in soft yellow, *D. enneandra* in silver and white—are here. *Penstemon glaber,* blue to intense purple-blue, flowers mainly in July. The sand-lilies or blazing-stars (*Nuttallia*—or *Mentzelia—stricta* and *N. decapetala*) contribute large stars of cream. Enchanting fronds of silvery foliage and silvery rose fingers of bloom are put forth by the hairy prairie clover (*Petalostemon villosum*) in late summer.

Not a few of the long-season bloomers continue into late fall when they are augmented by numerous asters, golden-rods and the golden-flowered rabbit-brushes (*Chrysothamnus*). The better late asters include *Aster kumleini* in blue and a fine pure pink; *A. batesi* with a lavish complexity of racemes of tiny florets in lavender-blue, deep blue, or pink; *A. fendleri,* to 10 inches, a natural rock species, with cupped rays of lavender-blue. *A. geyeri,* Black Hills form, has been traded about in gardens since early days and has few rivals among garden hybrids. It grows to 40 inches, with dark glossy stems and leaves and large trusses of very large flowers of blue. *A. ericoides* with crisscrossing ropes of tiny florets is a conspicuous white. Among the golden-rods, *Solidago pallida, S. nemoralis, S. pulcherrima* and *S. wardi* are all well behaved and highly regarded. One of the most brilliant is the low *S. mollis,* a colony-former.

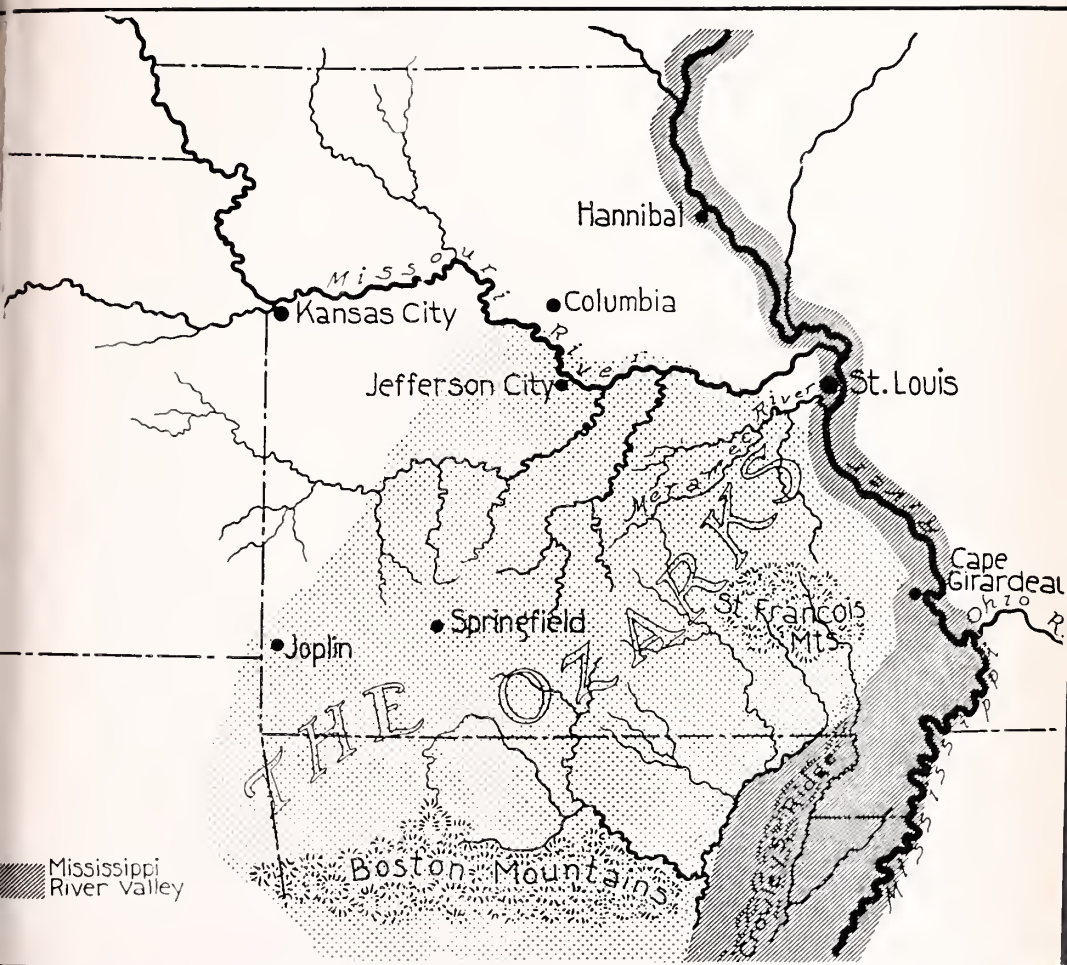
Not to be omitted here is mention of a dozen or so kinds of engaging prickly-pear cactus (*Opuntia*) and ball types of other genera. Their novel forms both attract and repel, their showy blossoms glow with inner colored fires. They are readily grown everywhere.

A long-time project of growing and evaluating every available species of the Great Plains in a dry prairie garden in western South Dakota has uncovered a surprising adaptability to garden culture in most kinds. They even improve under cultivation, and show rare beauty and desirability.

CLAUDE A. BARR, who has brought into cultivation several score of native plants of the Western Plains.

WILD FLOWERS OF THE OZARKS

Edgar Anderson



OZARK MOUNTAIN region, which extends from southeastern Missouri into northern Arkansas. The highest point is reached in the Boston Mountains.

A PERCEPTIVE naturalist, visiting the Ozarks, is impressed by two things, distinctive Ozark endemics and the strange aspect there of many, more widespread species. Sugar maples are much the same from New England and New York State westward to Michigan, but come to the Ozarks and they are smaller, wartier, and more picturesque. Similarly, to one from the East, the red-cedars are more variable, and with more conspicuous berries; the hepaticas and Dutchman's-breeches are brighter in color; the flowering dogwood tends to have denser masses of bloom, the common red and yellow columbine to be a taller and more branched plant than back in Pennsylvania and New York.

We have a fairly simple explanation for many of these differences; the story is most easily demonstrated for our redbuds. One does not need a very sharp eye to note as he travels westward from St. Louis in the spring, that the redbuds vary somewbat in color from one bush to anotber, wbile when one travels towards the East they become more and more uniform. To find the explanation of this variation one merely has to drive on westward until he comes to the Arbuckle Mountains of central Oklahoma. Here are hybrid "swarms" of redbuds, the likes of which cannot be found elsewhere. The Texas redbud, a shorter, bushier, more drought-resistant tree, with smaller leathery leaves and brilliant big flowers, bas hybridized with the common eastern redbud; the Arbuckle Mountains are thus populated with their mongrel descendants. Flowers vary from deep to pale, from large to small, from flowers all of one color to specimens witb upper petals of deep pink and lower ones of light pink. Our somewhat variable Ozark redbuds have a lesser pinch of tbis same mongrel ancestry.

During the xerothermic or "hot-dry" period of the past the Ozark climate was much drier than at present. The eastern red-cedar bybridized with the Mexican red-cedar, the common sugar maple with the drought-resistant maple from Caddo Canyon, the columbine with some of its more drought-resistant southwestern relatives. When better times brought back a moister climate, some of tbese mongrels lingered on. Today if one goes to rocky west or south-facing slopes in the Ozarks, he can see redbuds, sugar maples, red-cedars, and columbines all growing together, all somewhat different from their relatives in the East, all varying a little in the direction of more drought-resistant species or varieties from the Southwest.

The Ozarks are a rocky low plateau, characterized by winding rivers, tbeir narrow valleys frequently bordered with steep cliffs. Technically the Ozarks begin at the very southwestern edge of metropolitan St. Louis and extend to the Arkansas border and just beyond, where they are joined by a smaller, more mesa-like plateau, the Boston Mountains. In one small central area the underlying granites and porphyries come to the surface in low, wbale-backed "mountains," one low sharp peak, Pilot Knob, and many beautiful little granite gorges, locally known as "shut-ins," where clear streams find their way down to the surrounding areas of softer rock.

Spring by northern or eastern standards is a long-drawn-out affair in tbe Ozarks and includes mucb sunny weatber. The distinctive winter-blooming witch-hazel comes into blossom in warm spells from December to April and is by that latter date accompanied by the full tide of spring bloom which lessens as May approaches—wben it reaches an almost flowerless lull before tbe summer wild flowers come slowly into blossom in late June. Summer lingers, both as to temperatures and as to character of bloom, well into September, wben autumn wild flowers take over until tbe shortening days of mid-October bring a halt even if frosts have not yet arrived. There tben remains only tbe Ozark race of ladies'-tresses (*Spiranthes cernua*) which may be found on sunny and rocky hillsides as late as the second week in November.

The Ozark witch-hazel, *Hamamelis vernalis*, grows on stream banks and in a blaze of light on gravel bars. Selected forms of it are now generally available in the trade witb flowers all the way from dull gold to Cbinese red in color. In planting them one needs to remember that the flowers are smaller than tbose of the eastern witcb-hazel and that they look their best when one sees the sunlight coming *through* them. Seen with the sun behind one's back they look dull and smudgy, particularly since some of last year's browned leaves characteristically stay on the bushes until after the flowering season. The leaves are otherwise most attractive, large but closely set and turning to a clear orange yellow in late autumn. The flowers are fragrant, a kind of heavy sweetish nutmeg scent reminding one of some tropical orchids. When the wind is right, on a sunny Marcb day a

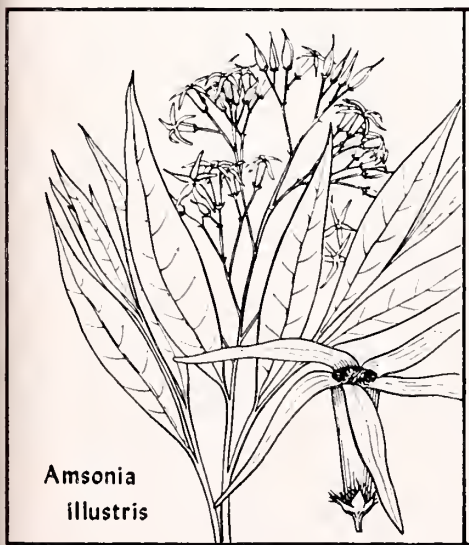
group of them can be smelled up to a quarter of a mile away.

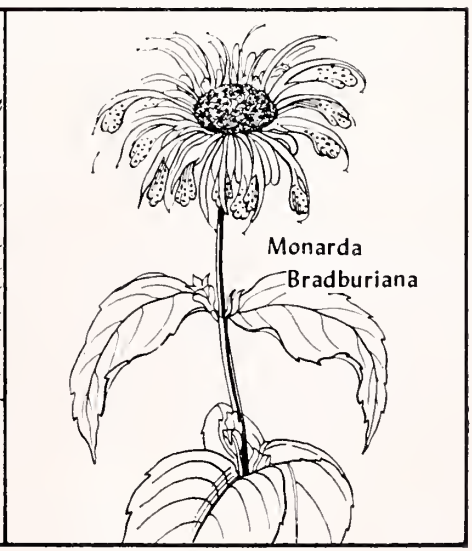
The Ozark amsonia, *Amsonia illustris,* as a garden plant, is a great improvement on its eastern counterpart *Amsonia tabernaemontana,* since it forms a tight clump rather than wandering all over the garden, and is much more floriferous. It has large attractive panicles of gray-blue flowers marked with white and dark blue which repeat almost exactly the color combinations of old-fashioned Canton china. *Amsonia illustris* seems to have no pests and diseases and its almost willow-like leaves turn attractively to a golden yellow-brown in the fall. Its only real fault as a garden plant is that it is a rampant feeder, even though not at all coarse in aspect, and it makes a too demanding neighbor for fine perennials. I find that it crosses readily with the beautiful and much less aggressive *Amsonia hubrichti,* with flowers nearly as large but in tighter clusters. The hybrids and their backcrosses combine the best features of both parents. They give over a month of bloom in late spring, attractive fine-leaved foliage throughout the summer and then a slow ripening from green to golden brown, turning finally to a coppery cinnamon before the leaves fall.

Monarda bradburiana, or June bergamot, is closely related to the commoner summer-flowering monardas such as the lavendar balm and Oswego tea. It is a pale lavender-pink, the intensity of the color varying from plant to plant and from one part of the flower to another, set off with spots and lines of cinnamon brown. There is so much variation in color and scent in the plants one finds in Ozark woodlands, that it is possible to build up a choice collection of pinkish plants with delicate scents. The June bergamot is somewhat shorter than the summer-flowering monardas but has even larger flower heads; with just a little encouragement it makes attractive large clumps in sun or light shade.

Eupatorium coelestinum, the wild ageratum or blue mist-flower, is a little taller than the bedding plant which it so closely resembles. Some plants are a more purple in garden effect due to more color in the stems. Hardy perennials, they spread rapidly through a border and might be a nuisance were it not for the fact that they may be weeded out with very little effort when in full flower.

From early autumn to late October the Ozarks are aglow with asters, several lovely species being endemic there. Taking asters out of the wild and into a perennial garden is a tricky business. Most of them





tend to grow into something much more coarse than they were in the woods and the prevalence of aster pests and diseases may make them undesirable in most American gardens. Two species from the Ozarks are both sturdy in constitution and refined in their growth habits: *Aster anomalus*, the mauve aster, and *A. turbinellus*, the Ozark aster. *Aster anomalus* is really quite as unique as its name suggests. It has leathery heart-shaped leaves and large flower heads backed by grotesquely curving bracts. The disk flowers are a clear bright yellow and the large numerous rays a true mauve. "Mauve," said Whistler "is pink, trying to be purple." It is an arresting shade, rare in wild flowers. On most specimens seen in the wild there are a few large flower-heads set fairly close to the gracefully arching stem. In the garden (particularly if one pinches them back once or twice) they branch out attractively (but do not become coarse) and make a brilliant panicle of bright mauve for a week or two.

Aster turbinellus has medium-sized heads of a clear bright blue. The leaves are narrow, heavy in texture and of a bright dark green. The flower-heads are borne on slender, wiry, branching panicles. Grown in the perennial border they branch and rebranch into a wiry maze which bursts into flower dramatically and quickly becomes a uniform mass of brilliant blue stars that remain attractive for a fortnight or more.

Most sunflowers are more or less weedy but the species which finishes off the blooming season, *Helianthus maximiliani*, is elegant in form though of such gigantic size as to deserve a spot by itself. Specimen plants will be three feet across or more; the tall wands of golden bloom (remarkably golden even for a sunflower) rise up eight to ten feet high; the separate flower heads, as wide across as the palm of your hand, are borne on short side branches so that the inflorescences remain formal looking. Most regal of all our sunflowers, it is named for the aristocratic naturalist, Prinz Maximilian von Wied-Neuwied who discovered it on his trips of exploration to the American frontier, a century and a half ago.

H. W. Rickett

ASTER ANOMALUS, large-flowered and bright mauve, is a handsome wild aster of midwest fields and roadsides. The reflexed bracts beneath the flower-heads help to identify the species. In cultivation in St. Louis gardens and elsewhere.

NATIVE PLANTS ARE NOT NECESSARILY PEST-PROOF

Cynthia Westcott

IT is a common belief that the use of native plants in our gardens will solve or reduce our pest problems. This is fallacious. Our wildlings have a variety of pests in their native state and often acquire more when moved in with cultivated neighbors. Plants are plants, whether native or introduced, and, like everything in nature, subject to enemies. Most of these can be safely ignored; some can be avoided by forethought in planting; some can be taken care of on a regular garden spray schedule. For specific treatment of specific pests consult the books and bulletins on insects and diseases of garden plants. See also the Brooklyn Botanic Garden's Handbook, *Plant Pests and Diseases and Their Control*. This brief discussion merely gives a little perspective on such problems.

Hundreds of leaf-spotting fungi occur on native plants but it is not often necessary to do anything about them. Mountain-laurel growing wild under tree drip is likely to be disfigured by a leaf spot and a leaf blight. If such shrubs are transplanted into a garden in nearly full sun the severity of the disease is greatly reduced without resorting to sprays.

On the other hand, spraying may be quite necessary for native rhododendrons moved from the woods to a sunny location. The rhododendron lace bug shuns the shade but is omnipresent in sunshine. In this case, unless you wish unsightly yellow foliage, you need one or two applications of lindane or malathion. The azalea lace bug attacks native deciduous azaleas as well as their oriental cousins but since their foliage is lost by the end of the season the damage is not as conspicuous as on the evergreen varieties.

Deciduous azaleas, like New England asters and many other native plants, are subject to powdery mildew in late summer but there is little damage except in appearance. You may, however, want to spray the asters for green aphids clustering around the flowers.

Dogwoods are subject to cankers and borers. Care in transplanting and in the use of the lawnmower helps to avoid the former; spraying trunks with DDT or dieldrin helps to avoid the latter.

Many native plants, such as sassafras, Virginia creeper, hardhack, and some ferns, are on the preferred food list of Japanese beetles. If beetles are numerous in your vicinity, such natives may be sprayed along with the roses and other cultivated shrubs. Bittersweet moved into the garden will almost surely require treatment for euonymus scale.

The European holly leaf miner seldom bothers English holly; it much prefers American holly. Spraying with Diazinon or DDT when the tiny black flies emerge in late spring prevents most of the ugly blotch mines. Most gardeners ignore the serpentine tunnels of the columbine leaf miner.

Fire blight, the familiar bacterial disease of apples, pears, and quinces, may also affect wild serviceberry (*Amelanchier*), hawthorn, and crab apples. Cut out the blackened shoots well below the portion that is visibly infected.

Native crab apples may be a serious problem in gardens if they are planted near red-cedars (*Juniperus virginiana* or *J. scopulorum*) which are alternate hosts of the cedar-apple rust. Although the cedar galls are conspicuous in spring when they are covered with the gelatinous orange spore horns, the rust is not particularly harmful to its juniper host. It is often quite injurious to the crab apple. Orange spots on foliage and dieback of twigs and branches are followed by general loss of vigor and occasionally by death. Unless it is possible to cut down the red-cedars, or to remove all the galls

before spring, or to indulge in a complicated spray schedule it may pay to use resistant Asiatic varieties in place of our lovely natives.

Rusts are common on many wild plants. Rust is frequent on wild iris, rare on cultivated. At least eight rusts occur on our American wild roses but only one species is a problem on cultivated hybrid teas and this one mostly on the Pacific Coast. These are autoecious rusts, completing their life cycle on the same plant.

Of the heteroecious rusts, requiring another type of plant as an alternate host, the cedar-apple rust is most important for the home gardener but there are others that might be considered in planning garden companions. There are dozens of rust species that alternate between: ferns and balsam fir; azalea and hemlock; anemone and plum or cherry; amelanchier and juniper; aster or goldenrod and two- and three-needled pines; flowering currant and white pine; huckleberry and hemlock; blueberry and fir or spruce; hydrangea and hemlock; oak and pine; pine and sweetfern; rhododendron and spruce. Although we seldom pay any attention to such combinations the results may, in certain localities, be unfortunate.

Far more important, in my estimation, is the responsibility of the gardener to see that dangerous plant material is not imported either into his state or his garden. Visual inspection should suffice to keep out violets infected with scabby spot anthracnose and other diseases with aboveground symptoms. But when plants are balled and burlapped or sold in containers it is very difficult to avoid dangerous soil hitchhikers. The black vine weevil frequently enters gardens in this way. The grubs, gnawing off the roots, may kill newly transplanted yew and hemlock; the adults make notches in the needles and in rhododendron and azalea leaves. Chlordane is recommended as a soil treatment for grubs, lindane or dieldrin for the adults chewing on foliage.

Cyst nematodes are perhaps the most dangerous crop pests that may be transported in soil, but for ornamentals I worry more about the transportation of sclerotia, those hard resting bodies, often minute, that enable fungi to survive unfavorable conditions over long periods of time. By means of such sclerotia the devastating azalea flower spot or petal blight spread rapidly through the South and is established as far north as Pennsylvania. It now endangers practically all native azaleas, rhododendron, and mountain-laurel. Anyone who lives in a state now free from this disease and orders azaleas from a state where azalea petal blight is widespread (without stipulating that the plants shall be bare-rooted with all soil washed off and with all flower buds showing color removed), is, in my opinion, guilty of subversive action.

WILD FLOWER PRESERVES, TRAILS AND AREAS TO BE VISITED

Compiled by Percy L. Ricker with additions by Edgar T. Wherry

Arizona

Boyce Thompson Arboretum, Superior.

Saguaro National Monument, near Tucson.

California

Coastal Route 1 from Los Angeles to Monterey (spring).**

Route 91 from Mountain Pass to Barstow.

Route 66 to Santa Barbara and beyond.

Muir Woods National Monument, 2 miles southwest of Mill Valley.

*Point Lobos State Park, near Carmel (May and June).

Torrey Pines Preserve, La Jolla.

*Yosemite National Park (after July 15).

Cheyenne Mountain Nature Preserve, Colorado Springs.

*Rocky Mountain National Parks, Estes Park.

Connecticut

Fairchild Wild Flower Sanctuary, Greenwich.

Hubbard Park Sanctuary, Meriden.

Marsh Botanical Garden, Yale University, New Haven.

Litchfield Wild Flower Sanctuary, Litchfield.

New Canaan Sanctuary, New Canaan.

Pootatuck State Forest Nature Trail, New Fairfield.

District of Columbia

*Fern Valley Trail, National Arboretum, near Washington.

Florida

Everglades State Park, Homestead.

Tamiami Trail, Miami to Ft. Myers.

Route 1, south of Jacksonville.

Routes 19 and 98, Tampa to Pensacola and Jacksonville west (spring).

Georgia

Callaway Garden, Pine Mountain Preserve, Hamilton.

Illinois

Morton Arboretum, Lisle.

Indiana

*Indiana Botanical Garden, Hammond.

Maine

Baxter State Park, near Millinocket (June)

*Acadia National Park, Bar Harbor.

Maryland

Cylburn Wild Flower Preserve, Baltimore.

Massachusetts

Bartholomew's Cobble, south of Sheffield.

Minnesota

Eloise Butler Wild Flower Garden, Wirth Park, Minneapolis.

Mississippi

Route 90, across Mississippi and Louisiana (April).

*Areas marked with an asterisk have descriptive booklets. In addition, all Richfield gas stations in California, Oregon and Washington distribute colored wild-flower booklets containing maps.

**Dates given indicate the seasons of outstanding displays.

Missouri

Missouri Botanical Garden Arboretum, Gray's Summit.

Tucker Prairie, Route 40, East of Columbia.

Montana

Route 12, from Yellowstone National Park east (July).

*Glacier National Park (open after July 15).

New Hampshire

Alpine Garden, Mt. Washington (late June and early July).

Lost River Nature Reservations, Kingman Notch, North Woodstock (after June 15).

New Jersey

Batsto Nature Area, Wharton Tract, Greenbrook, Egg Harbor City.

Bennett Bog Sanctuary, three miles north of Cape May City.

Jockey Hollow Wild Flower Preserve, Morristown.

Lucine L. Lorrimer Sanctuary, Franklin Lakes.

Mettler's Woods, near East Millstone.

Watchung Reservation, Westfield.

New York

Bergen Swamp, Genessee County.

Wild Flower Garden, Brooklyn Botanic Garden, Brooklyn.

Wild Flower Garden, The New York Botanical Garden, Bronx Park.

Pound Ridge Reservation, Cross River.

Westmoreland Sanctuary, Mt. Kisco.

North Carolina

Holly Refuge, near Burgau (late May).

Pearson Falls Wild Flower Sanctuary, Tryon.

Ohio

Nature Trails and Museum, Cleveland Park System, Cleveland.

Harriet Keeler Memorial Woods Reservation, near Breckville.

Madden Park, Route 6, Dayton.

North Chagrin Nature Trail, between Mayfield and Chardon Road, Cleveland.

Fine Arts Garden, Plant Sanctuary, Euclid Ave. and East Boulevard, Cleveland.

Pine Hill Arboretum, near West Fairview.

Shaker Wild Flower Preserve, Cleveland

Oregon

*Crater Lake National Park, near Medford (after July 1-15).

Macleary Park Native Plant Sanctuary, Cornell Rd. via N.W. Lovejoy at city limit, Portland.

Route 50, from Rhododendron to Government Camp (mid-June).

Route 35 north, slopes of Mt. Hood (mid-June).

Pennsylvania

*Bowman's Hill State Wild Flower Preserve, Washington Crossing.

Tinicum Sanctuary, Philadelphia.

Powdermill Nature Reserve, Westmoreland County.

Ohio Pyle Preserve, Fayette County.

Tyler Arboretum, Lima.

Tennessee

Elise Chapin Wildlife Sanctuary, near Chattanooga.

Shelby County Forest, Bird and Plant Sanctuary, 15 miles north of Memphis.

*Great Smoky Mountains National Park, Gatlinburg.

Texas

*Big Bend National Park.

ittle Thicket Nature Sanctuary, Evergreen.

Utah

Zion National Park.

Vermont

Long Trail Lodge and Nature Trail, Sherbourne Pass (Green Mountains), 10 miles east of Rutland.

Virginia

Conway Robinson Memorial Forest, Gainesville.

*Blue Ridge Parkway, from Rockfish Gap near Afton, Va. to Asheville, N. C.

Jackonsville Memorial Wild Flower Preserve, Chancellorsville.

Pilgrim Rest Sanctuary and Nature Trail, adjoining Woodland Cemetery, Norfolk.

*Shenandoah National Park, Front Royal to Rockfish Gap (near Afton).

Washington

*Olympic National Park (after July 15).
*Mt. Rainier National Park (after July 15).

West Virginia

Oglebay Park, five miles from Wheeling on U.S. Route 250.

Wisconsin

University of Wisconsin Arboretum, near Madison.

Wyoming

*Yellowstone National Park.

(*Continued from page 37*)

Indian paintbrush (*Castilleja lindheimeri*).

Purple cactus (*Coryphantha vivipara*)

Plains-gentian (*Enstoma russelliana*)

Bindweed-heliotrope (*Euploca convolvulacea*)

Bluebonnet (*Lupinus texensis*)

Blazing-star (*Mentzelia decapetala*)

Wild four-o'clock (*Mirabilis nyctaginea*)

Fern-leaf evening-primrose (*Oenothera laciniata*)

Prickly-pear (*Opuntia humifusa*)

Large-flowered beardtongue (*Penstemon grandiflorus*). More easily grown over a wider area than most of the 250 American species.

Texas sage (*Salvia coccinea*)

Rocky Mountain Species

Sego-lily (*Calochortus nuttalli*)

Sulphur-flower (*Eriogonum umbellatum*)

Skyrocket (*Gilia aggregata*)

Panicled bluebell (*Mertensia paniculata*). Similar far-western species are plants of rich, damp, open woods, but also grow well from seeds in partially shaded gardens if kept well watered until seedlings are established. Seeds of the eastern *M. virginica* produce a carrot-like root one to three inches long, and do not flower until the second year.

Stemless locoweed (*Oxytropis lamberti*). This and several related purplish species are found from mountain slopes to the plains and prairies.

Shrubby cinquefoil (*Potentilla fruticosa*. One of the species that is found in many places from East to West and in some Eurasian countries in both wet and dry-rock areas. It will grow in average garden soil.

Spiderwort (*Tradescantia scopulorum*). This and many other species grow best in damp or wet places. Some, like the eastern *T. virginiana*, do well in partial shade and average garden soil.

Globe-flower (*Trollius laxus*). It and the similar but smaller western marsh-marigold (*Caltha rotundifolia*) prefer wet mountain meadows. Both have whitish flowers.

Southwestern Species

Century-plant (*Agave americana*)
Prickly-poppy (*Argemone mexicana*)
Barrel cactus (*Ferocactus wisilzeni*)
Blanket-flower (*Gaillardia pulchella*)
Small-flowered gaura (*Gaura parviflora*)
Pincushion cactus (*Mammillaria hemisphaerica*)
Fishhook cactus (*Thelocactus uncinatus*)
Spanish-bayonet (*Yucca baccata*)

Pacific States Species

Firecracker-plant (*Brodiaea ida-maia*)
Tall clarkia (*Clarkia pulchella*). Annual.
Spring-beauty (*Claytonia linearis*). The similar eastern *C. virginica* and various other species develop a small bulb four to six inches deep at the base of a slender, fragile stalk.
Chinese houses (*Collinsia bicolor*). The plants are annuals and do best in a partly shaded situation.
Wallflower (*Erysimum asperum*)
California-poppy (*Eschscholzia californica*). Grown as an annual.
Summer's-darling (*Godetia amoena*). Annual.
Baby-blue-eyes (*Nemophila insignis*). Annual.
Owl-clover (*Orthocarpus purpurascens*). Parasitic on grass roots.
Prostrate verbena (*Verbena prostrata*).

Adapted from *Seeds: The Yearbook of Agriculture, 1961.* United States Department of Agriculture.

NOTES FOR MY WILD-FLOWER GARDEN

NOTES

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CONSERVATION FOR EVERY MAN

SUMMER
1962

A Handbook
of Ideas

How to Help
In Preserving
Soil
Water
Trees
Wetlands
Wildlife
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NEW SERIES
VOL. 18 NO. 2

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American Museum of Natural History

FOREST COVER VERSUS EROSION. When trees or even smaller plants, including grasses, cover the ground, the soil is held in place and erosion prevented. When a cut such as this is made, erosion is inevitable. Erosion of soil means not only loss of humus and mineral richness for plants, but also loss of water, which can be retained in root-enmeshed earth. Good soil and water stand at the top of the list of the natural resources that are essential to life.

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Summer 1962

The word CONSERVATION (the wise use of Natural Resources), with a little switching of letters, quickly becomes CONVERSATION; and it was only that, at least for many decades, in a younger America. Resources were so vast and the population so small that, seemingly, there could be endless waste without public concern. But as natural resources dwindle and the population grows, there is an increasing awareness that "somebody" must do "something."

Most CONSERVATION problems call for community action and should not be passed along to State or Federal Governments where, as often as not, they come to nothing. Legislative bodies are rarely in a position to take appropriate action unless the particular situation is extremely serious and complicated, or too costly for private financing.

In most primitive countries people are automatically conservationists without even knowing the word; conservation is the prevailing natural law of "wise use" that governs the life of primitive societies. No simple aborigine would think of over-exploiting his environment. I remember a native on the beautiful Samoan island of Tutuila once asking me, "How many children in your family?" When I replied "two," he said "not enough." I pointed out that support, education, etc., made a large family economically difficult for most people. His answer was about as follows: "Why worry about things like that? In Samoa you step outside the door of your house and pick the fruit that is waiting to be eaten. . . . Maybe a man has a little garden, but not really necessary . . . when fish come in along the shore, whatever hour of day or night, everybody works with the nets." He concluded our conversation by pointing out that he had eight children who brought him much happiness; that he had no worries, no cares. While the word CONSERVATION would have meant nothing to him, he practiced it in his own simple daily life.

Most of us would not trade our civilized existence for the life of my philosophical Samoan acquaintance, yet the fact is that civilization has so busied our lives that we have little time to reflect on the value of the simple principles of living. Hans Margolius observed that only in quiet water do things mirror themselves undistorted; only in a quiet mind is there adequate perception of the world. We have too few quiet minds in a society complicated by civilization's many advantages. The urge is great to do more and more, and—it seems to me—to think less and less. The basic concept of "balance in nature" is too frequently ignored. Yet the fact that most of us live an urban life does not diminish the need for understanding, and for intelligent action.

What of the balance in nature? Let's get back to the principles. We can not turn back civilization's clock, nor do we want to. But there are steps we can take that will bring us into better harmony with our natural world, and put us in a position to use our resources more wisely. This is the nub of CONSERVATION, and the message of this handbook. Civilization's complexity has made it a necessity. If we think we can long ignore the need for it, we are tragically mistaken.

Heartening it is to see more and more conservation activities at the local level. *Action by individuals!* Guest Editor Murphy's assignment was to dig out successful examples for others to see. The authors she invited to participate are people with inspiring records of accomplishment. They have set patterns that others will be glad to learn about, patterns that can be successfully followed in other communities or situations. It is both a pleasure and a happy satisfaction to acknowledge the part contributors and Editor have played in creating this guidebook to conservation—for *every* man.

Sincerely yours,

George S. Avery

Director

CONSERVATION PRIMER

Basic points for every reader

Grace E. Barstow Murphy

AMAZEMENT has flooded over me as I have learned how much success in all kinds of conservation-adventure has been won by dedicated people over all our United States. In the face of these achievements it is difficult to realize how much still needs to be done, how enormous is the number of people still blind and deaf to the importance of conservation.

If we think back to earlier days we can realize what it means to us in America that wise men saved for us such great national parks as Yellowstone, Crater Lake, Grand Canyon, Shenandoah and a host of other treasures which we take for granted. What would New York City be without Central Park in Manhattan, Prospect Park and the Botanic Garden in Brooklyn, Bronx Park and The New York Botanical Garden in the Bronx?

Thinking back should give us all an understanding of the importance of such bills as the Wilderness Bill, now before the Congress. The work must go on. Because of the increasing population, there is increasingly urgent need to set aside adequate tracts of land for the long-term future. There is and always will be pressure to use land selfishly, without vision for the greater public good. We must lead all our people to understand this fact. One way is by encouraging the new movement to acquire small wild areas or ponds, or both, near school grounds. Bringing the children to Nature, letting them see at first hand the dependence of each living object on others, will create an army of conservationists. That way they will learn to take care of their country as naturally as we take care of our individual homes.

CLEAR-FLOWING RIVERS are important to all life.

John H. Gerard from NAS

U. S. Department of the Interior

AT LEAST A FEW "great open spaces" should be preserved near cities.

But until such knowledge is general, what can we do to guard the natural resources of our country? What are the basic conservation subjects essential to the welfare of our land?

First comes the need for public education. Generally speaking, we are slowly bringing our people to understand such common needs as keeping our highways clean. Imparting the many tenets of conservation is more complicated, but it can be done.

Water, basis of all life

Teaching the importance of *water* should be the first lesson in education, for water is the basis of all life. Each one of us is 70 per cent water. Without it, we and all other living things would dry up and die. It seems strange that many have little respect or appreciation for it. We have let many beautiful clear-flowing rivers become dark with filth and debris, till the cries of water pollution and water shortage fill the land. Every one of us should know the ABC of water as presented later in this handbook.

Fertile soil for survival

The importance of soil naturally follows water. Without soil, it would be difficult to grow our familiar food crops and to pasture cattle for our survival. Our well-being stems from fertile soil. The article beginning on page 17, on the Soil Conservation Districts, shows how earnestly our experts work on the problems of our soil.

Trees to save the soil

Forest trees conserve soil by preventing erosion. While their growth demands

Carol H. Woodward

FERTILE SOIL means food, and cultivated fields give serenity.

large quantities of water, the transpiration from their leaves humidifies the air, and this moisture, rising, forms clouds which come down as rain. The process is continuous. Trees also help save soil when they form a barrier that checks erosion by wind, rain or snow.

Ways to hold soil in place

Erosion means the wearing away of soil by running water, wind, waves, ice. Erosion by running water produces gullies and ravines. Strong wind may blow precious topsoil away, leaving barren land. Seacoasts are eroded by ocean waves. Ways to prevent soil erosion are by reforestation, terracing, plowing across slopes instead of up and down them, filling eroded places with quick-growing, deep-rooting vegetation. Such vegetation prevents erosion and also makes a place for wildlife. Here and there people in rural settings are letting their grass plots grow. Thus, instead of tailored lawns, they have unmown meadows of wild flowers.

For purer water

The danger of present-day detergents and the need for safe sewage disposal are two subjects we should understand for our

IN THE GREAT WESTERN PLAINS REGION, bison were once a part of Nature's scheme.

U. S. Department of the Interior

FOREST TREES are natural soil savers.——→

health and survival. Both affect the purity of our water supplies, and they are closely linked.

Ponds, streams and wetlands

The importance of preservation of open water in ponds and streams, also the saving of our wetlands, both fresh and brackish, need to be understood and given attention. Pond building and stocking with edible fish should be increasingly practiced. Ponds help in at least a small way to cut the dangers of serious droughts.

Wildlife a part of every environment

Wildlife of every kind is intertwined with this need we have for the well-being of our environment. Bees pollinate the flowers. Birds and snakes eat insects and keep their numbers in control. We still have much to learn about the whole cycle of life, with its interdependence of one part on another. Every child and adult should understand the significance of this scheme.

For the human spirit

Beyond all these practical aspects of the conservation problem lies the need of human beings to commune with Nature and with beauty. Our spirits require us to be at one with Nature with the same urgency that a child requires its mother's love—for wholesomeness, for growth, for health, for balance. We cannot escape being a part of Nature, even though, to be free within ourselves, we must interpret our own role.

The need for help

There are uncounted thousands of men and women fighting to save our country's natural values.* A common goal, in ad-

*In addition to the material presented in this handbook, many success stories have come in for which there is no room. I should like to have had space for the group at Kings

Grant M. Haist from NAS

Allen D. Cruickshank from NAS

PRESERVATION OF WETLANDS is an aim of many conservation groups. ——→

Allen D. Cruickshank from NAS

A SINGLE WREN will feed 500 insects to its young in one afternoon. Encouraging birds reduces garden pests.

dition to the preservation and the wisest possible use of the natural resources of our country for all time, is the appreciation of these things. All of us feel the battle from the heart. Many fights are won, but some are lost, and they are getting hotter and harder as the time grows shorter. We are losing to the highway engineers who can build good roads but seem to be insensitive when it comes to land and cultural values. They bulldoze needlessly and trees fall which with care and foresight could have been spared. They make plans to bisect fine old towns, to cut nature sanctuaries in two, destroy historic sites and ruin clear streams and ponds. The modern rush out of the cities into our countryside, made possible by automobiles, proves how Americans love out-doors. But highway engineers must not be allowed to ruin what is irreplaceable merely to speed the flow of automobiles.

Why, then, is the fight "to save" so hard? Perhaps it is due to the fact that we are smug in taking our wonderful country as a static matter of course. Perhaps we are all having too good a time to be worried or to bother. Perhaps our greed for money blinds us to the greater needs and values of life even at the very moment when we pack the children into the car to drive them to see the Mammoth Cave. On the way, we take the contour farming and erosion control that we see as only part of the landscape. Read the brief story of Ira Gabrielson in this handbook, and see how often the word "fight" occurs. The early pioneers of land use and wildlife care are our truest heroes.

Many of our elected and appointed representatives in government see the need for conservation, but one of the greatest needs is for broader understanding at the local level. The Water Pollution Conference in Washington in December 1960 awakened enormous numbers of people to the horrid fact that most of our rivers are filled with filth and that sewage from our millions must be treated before permitting it to go into rivers.

It is acknowledged that the public is influential in determining the course of legislation. When the people, having learned the facts and facets of conservation, write letters of instruction to their legislative representatives, then we can truly advance in conservation activities. Our lives as individuals, as well as our communities and the Nation, depend on how we use our natural resources. Conservation is not only the wisest economic practice for our country, it is also a philosophy of life, a habit of thought that is wholesome, out-giving and enduring.

Point Park, on Long Island, who worked very cleverly to keep their marshy woods from being turned into a golf course. Left in their natural state, these lovely woods serve more people of more kinds as they are, and bring joy as people picnic at the unobtrusive, shaded tables. I should like to tell of the struggle in Smithtown, Long Island, carried on by one young man alone to save tall evergreens. All across the country, similar tales of triumphs can be told. Many will be found in "This Land of Ours" by Alice Harvey Hubbard.

CONSERVATION AND THE HOMEOWNER

Alice Harvey Hubbard

WE often think of conservation as of special benefit to farmland. But many of the farmer's conservation practices are also helpful to the homeowner, whether his plot is large or small.

The best use of the land

For example, one of the first things a farmer learns when undertaking a conservation plan is to use the land according to its capabilities. Not all the land on a farm may be suitable for crops; some of it might better be put into a pond, some in woodland, partly to furnish a habitat for wildlife. So it is with the homeowner. Perhaps his land is located in a sunny spot, with good topsoil, permitting a fine lawn, sun-loving flowers, shrubs and ornamental trees. On the other hand, it may have been stripped of its topsoil by a builder out to make a quick dollar, leaving the luckless owner with the task of rebuilding impoverished soil before he can hope to have the horticultural beauty on which he has set his heart. Then again, the home may be on a woodsy site, with tall trees that permit little grass and only shade-tolerant plants. Whatever the homeowner has, he too must learn to let the land itself determine its use.

Conservation and horticulture are closely allied. The beautiful lawn the homeowner takes such pride in is a conservation measure. The grass holds the soil in place, preventing it from blowing or washing away, just as do the tough grasses of the great western plains. The root region of the grass serves as a blotter for rainfall, holding the water where it falls and letting it filter down into the underground reservoir rather than running off—another good act of conservation. In short, grass keeps the topsoil home where it belongs—and rainfall too.

Understanding the soil

Good gardening, like good farming, begins with an understanding of the soil. The first lesson to be learned is the knowledge that plants and the soil are essential parts of a whole, each influencing the other, and both responding to the climate.

The two principal aspects of soil productivity are its structure, or tilth, as the knowledgeable growers say, and its fertility, or the content and balance of available plant nutrients. The structure of the soil has a direct bearing upon its water-holding capacity, its warmth in early spring, the ease with which it can be worked, and the penetration of plant roots and consequent nutrition of the plant.

Organic matter in the garden

What many gardeners overlook is the fact that organic materials, as well as chemical, or mineral, fertilizers, need to be added to many soils to make them productive. Humus, a vital material formed of decayed vegetable and animal (organic) matter, helps to conserve moisture in the soil, loosens soil particles to permit air and water to permeate them, furnishes some plant-food elements, and, through the activity of the bacteria it may contain, makes available for plants some mineral nutrients which might otherwise remain inaccessible.

Three of the most common kinds of humus are peatmoss, which decomposes slowly and furnishes some nutrients, leaf-mold, which is rich in organic matter and highly retentive of moisture, and compost, a major source of organic matter for the gardener. Mineral fertilizers supplement humus, but in no way do they replace it.

Peatmoss is generally purchased in bales, but leaf-mold and compost are cost-free, home-made products. The compost

heap, which may contain almost any kind of organic refuse, provides material rich in plant nutrients and high in humus content. It is equally good for lawn or garden.

Leaves, whether left on the ground to decompose or added to the compost heap, will in time return to the soil the elements that growing plants have taken from it. The reckless practice of burning fallen leaves is akin to burning dollar bills.

Homeowners who cannot use all their fallen leaves are now often contributing them to the town for a community compost heap. This practice provides humus for parks and public grounds and also for sale at a modest price to homeowners who have no place for a compost pile of their own.

Holding water in the soil

Because plants derive their nutrients from the soil in the form of a solution, water plays an important part in the health of any garden or lawn. In a rain what really counts is how much of the water enters the soil. The amount depends not only upon the season and the nature of the precipitation, but also upon the condition of the soil. Good friable soil has a spongelike quality; it absorbs and retains moisture whether there is a gentle, continuous rain or a cloudburst. On the other hand, a heavy rain will bounce off a closely packed soil. Even in a gentle rain, some moisture is lost because hard soil does not absorb water.

Terraces, mulches and ground covers

On a slope, terracing prevents runoff and gives the soil a chance to absorb all possible moisture. In some instances, contour planting, even of a garden, is advantageous. The use of mulches is another well-known way of holding moisture in the soil. Since we cannot control the weather, such measures are extremely beneficial in periods both of heavy rain

Brooklyn Botanic Garden

SHEET EROSION EXPOSES TREE ROOTS ON A HILLSIDE. When grass or other groundcover plants cannot be maintained on slopes, rain washes topsoil away evenly over the whole expanse.

Brooklyn Botanic Garden

BEFORE CHECKING SHEET EROSION. Even on a gentle slope, where the shade of trees makes it next to impossible to grow grass, erosion of topsoil will leave tree roots exposed. The soil here has continually washed down onto the sidewalk.

AFTER TERRACING AND PLANTING. Originally there was an eroded slope here, similar to that in the picture above. To prevent the continuance of erosion, a low wall of granite blocks was built at the edge of the walk. Topsoil fill was put behind it, and the former slope then became level ground. English ivy grows here successfully as a ground cover, under the shade of the trees. The slanted, short iron posts carry a single wire to discourage people from walking on the ivy.

Brooklyn Botanic Garden

Carol H. Woodward

WOODED AREA. When a tree-covered tract adjacent to one's house can be left in its natural state, birds and wild flowers will be encouraged to live and grow there.

and prolonged drought. They are all good conservation practices. When moisture is held in the soil, erosion does not take place.

Erosion is a natural process that has been occurring throughout geological time. It has sculptured many of the features of our landscape. But on the home grounds it is unsightly, and it results in a loss of valuable topsoil. Since the homeowner is most likely to have an erosion problem on a slope or bank, an examination of the many ground covers available is helpful. They protect the soil and conserve the rainfall, and are attractive. It sometimes requires a year or so for a ground cover to become established, but once it takes hold it requires little attention.

Windbreaks for protection

A row of trees and shrubs such as farmers use for a windbreak can be useful on the home grounds, too. In exposed situations, the planting needs to be dense enough to reduce wind velocity and thus prevent the drifting of snow, even the blowing of unplanted soil. A windbreak can provide shelter for the house, the garden, and for tender shrubbery in winter, privacy for outdoor enjoyment in the summer, and cover and nesting sites for birds. The selection of trees for this purpose depends upon the climate and soil, the location of the house, and the size and extent of the windbreak. In general, evergreens that retain live branches close to their base throughout the year are considered most desirable.

Birds and wild flowers

The larger the bird population on one's place, the more insects and seed pests will be destroyed. Therefore, any planting that provides shelter, nesting sites, and food for birds represents good conservation. Since birds are particular about their diets it is well to provide a

variety of shrubs, especially berried ones. It is also desirable to maintain a wooded area in its natural state on one's property.

A measure often overlooked by the homeowner is the protection of wild flowers. As with birds, their natural habitats are being destroyed so rapidly that they should be safeguarded wherever possible. The homeowner can help by respecting their sanctity where they are growing, saving as many as he can from the path of the bulldozer, and propagating them to increase their numbers. In establishing a wild-flower garden of his own, he will do well to purchase plants from nurseries that specialize in native species. Wild flowers are often fussy as to their requirements, it is true, but the pleasure they give is well worth the effort of learning the kind of home they must have.

There is no line of demarcation between conservation and good gardening. More often than not they are the same. Conservation is not hoarding or penny-pinching; it is the intelligent use of natural wealth—of the heritage that has been passed on to us and which we, in turn, should pass on to others. Each homeowner who takes care of his own little corner of the U.S.A. is helping to protect and enrich that heritage.

HOW TO MAKE TOPSOIL FROM SUBSOIL

In four easy steps

WHEN topsoil has been stripped from the ground and sterile-looking subsoil lies on the surface in its stead, a gardener need not despair, for subsoil can be easily converted into stuff that will produce sturdy plants. Most of the mineral elements necessary for plant nutrition are already present in the subsoil. The primary need is organic matter, along with a nitrogenous fertilizer. The following method has proved successful:

1. The subsoil is plowed.
2. Immediately after, these ingredients are spread over each 1,000 square feet of the plowed ground:
   rotted manure (2½ cubic yards); compost may also be used
   coarse sand (1 cubic yard)
   ground limestone, especially if the subsoil is acid (100 pounds)
   commercial fertilizer, preferably high in nitrogen (100 pounds)
3. All ingredients are mixed into the subsoil with a power tiller.
4. After the soil is settled (in about two weeks), seed may be sown.

Instead of the crop desired—lawn, vegetables or flowers—the seed may be of a cover crop, such as vetch or buckwheat. This is then plowed under after flowering but before setting seed. Again, after the soil has settled, seed may be sown—this time, either of another cover crop or of the useful or ornamental plants planned for the area.

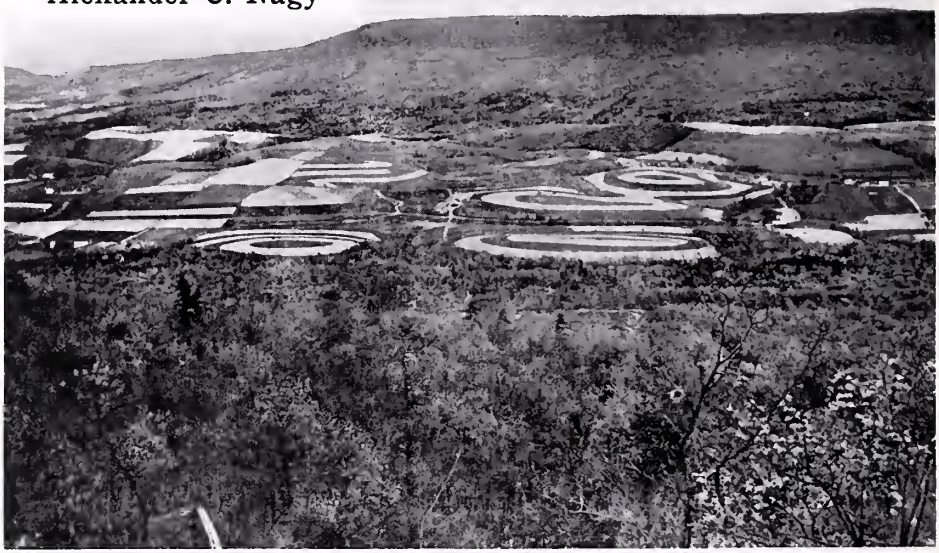
This schedule of preparation is to be recommended over the costlier one of buying topsoil to scatter in a two- or three-inch layer over the ground, as is sometimes done before a lawn is seeded.

HUNTINGTON'S TREES

The village merchants of Huntington, New York, displayed 105 live Norway spruces as Christmas trees in 1961. Later, they called upon the officials of Huntington to discuss the best use for these trees. Requests for them poured in. The decision was to plant them on the Village Green. This feature of a single Christmas season will thus become a permanent evergreen planting in the heart of the town.

BIOGRAPHY OF A FARM

Alexander C. Nagy



Maurice Broun

CONTOUR-PLOWED FIELDS. The Nagy farm in Pennsylvania has the longest field in the county. Plowed on the contour, it travels around two hills and is 1¼ miles long.

MY father's farm contains 260 acres of rolling shale farmland in Albany Township, Berks County, Pennsylvania, at the base of Hawk Mountain Sanctuary. The name "Albany," meaning "all wants," is said to have been given by the early Indian inhabitants because of the natural infertility of the soil. Its light composition subjects this land easily to abuse and ruin.

When my father purchased the place, the tenants who had farmed it for many years could no longer make a living on it. There were gullies big enough to drive a car into and hide. The fertility of the soil was so far gone that the grass grew only a few inches high and the fields were covered with ground blackberry.

The farm was typical of the Pennsylvania Dutch country: very little shrubbery or trees around the house; most of the fencerows eliminated to get larger fields for easier plowing and cultivating. There was little wildlife; except in the woods about all we ever saw was a small colony of English sparrows. A small creek in an overgrazed pasture ran through the property. The tenants had sold off all the salable timber, as often happens with farms that are losing money. The second-growth timber did have an abundance of grouse, but little else. Deer were also plentiful in the woodland.

Our first job when we bought the land was to get the help of the U. S. Soil Conservation Service. They made a survey and laid out the basic contour strips, also made the layout of the farm ponds. These are the standard conservation practices we followed:

1. Crop rotation, lime and fertilizer. We tried to use as much manure as possible and shy away from chemicals.
2. Contouring. Farming around the hillsides with the contour of the land, the furrows following these contours, instead of running straight up and down hill.
3. Strip cropping. Planting strips of grass or close-growing grains in the alternate strips of clean-tilled row crops. The grass strips will hold water and keep it from eroding the cultivated strips below. They will also catch any soil if there is erosion.

4. Terraeing. Building up a barrier of land to intercept rainfall. This is done on the eontour also. Terraees with a slight grade slow down run-off water, guiding it off safely.
5. Mulehing. Leaving the corn, wheat and oats stubble on the ground instead of burning it. This stubble protects the land from erosion, also adds humus to the soil.
6. Gully control. Filling in gullies whenever possible and seeding for a permanent grass eover.

In addition, steep hillsides which formerly were farmed and pastured were put into evergreens, primarily pines. All the odd little eorners that were inconvenient to farm were put into wildlife food plots. Bicolor lespedeza, Russian-olive, bayberry, highbush - cranberry, Tatarian honeysuckle, and multiflora rose were planted. These provided wildlife eover also.

Five farm ponds were established. Ten or twenty feet of land around each pond were feneed off to keep the livestock out. This area was used by nesting waterfowl. The ponds were stocked with large-mouth bass, bluegill, sunfish, and bullhead catfish. They have proved a good eombination. Bass measuring 18 to 20 inches are taken from the ponds.

The ponds, which total about three aeres, have had great value. Migrating waterfowl rest on them. New nesting records have been established for the county by tree swallows and pied-billed grebes. Spotted sandpipers, Virginia rails, mallards, blaeks and many other birds are found nesting around the pond areas.

Two large martin houses whieh were erected served to establish a eolony on the farm. Bluebird boxes lured in more birds.

Nine sparrow hawk boxes were erected. Seven pairs took residence in the summer of 1961 and established a reeord number of nesting pairs for the northeastern United States. These seven pairs raised 31 young. They feed mainly on inseets and field mice. These same boxes are used by sereech owls in the winter for roosting when the sparrow hawks have migrated south.

Donald S. Heintzelman

FARM PONDS. Three aeres of water surface are in the five ponds that were ereated on the farm. These furnish fish and attraet many nesting birds.

A mile and a half of multiflora rose was planted between the tilled farmland and the pastures. This so-called "living fence" has been priceless as far as wildlife is concerned.* It is an impenetrable hedge, used for nesting birds and fleeing rabbits, the fruits providing food for many wintering birds. The mockingbird, which was not here in former years, is now a resident because the multiflora rose furnishes it with food during the severe winter months.

The farm is a mecca for bird students, for we never know when a new bird will drop in. It may be several hundred Canada geese, or perhaps a rare blue goose, such as one which spent several weeks with us. Every birder within fifty miles came to see it.

The entire farm is a wildlife refuge and everything is geared with that in mind, although sheep and cattle are the main source of income. Esthetically, the wild creatures are a great inspiration. Each year as the plantings grow, new birds establish themselves. The farm is a haven for the cardinal as well as the hawk and fox. They all have their place in the realm of nature. Live and let live is our policy.

The flourishing farm of today makes a striking contrast to the worn-out, unimpressive, just-another-farm of fifteen years ago.

*The editors are not convinced that multiflora rose is an unmixed blessing; in time it may seed itself until it becomes a pest.—Ed.

WILDLIFE ON THE FARM

A booklet of 84 pages published by the Wildlife Management Institute tells precisely what to do to encourage wildlife on the farm. It "actually is a concise treatise on proper land use," the introduction states. The principles also apply to any rural landholding. In the summing up at the end it is stated, "Wildlife management on the farm consists principally in doing a good job of farming."

"The Farmer and Wildlife," which is profusely illustrated, was written by Durward L. Allen. Among the seven chapters are such topics as wildlife in the farmer's business, the nature of living things, and nuisance animals. Copies are available from the Wildlife Management Institute, 709 Wire Building, Washington 5, D. C.

Donald S. Heintzelman

Winter visitors. Canada geese, several hundred of them, have brought bird students from afar to the Nagy ponds.

SOIL CONSERVATION DISTRICTS

Technical aid for every type of land supplied without direct charge by tax-supported government agency

MORE than 90 per cent of the agricultural land in our country is covered by soil conservation districts. About 95 per cent of all our farms and ranches use the Soil Conservation Services of the U. S. Department of Agriculture. It is as gratifying a development in the United States as is the marvelous administration of our National Parks, the Fish and Wildlife Service, and other government bureaus that bring benefits to our people.

The Soil Conservation Service is comparatively new, the first district having been organized in 1937. The vision behind this movement must have been very great, and its realization very efficient, to have spread so far so fast. Today, twenty-three of our states are completely covered by districts and all fifty of our states are making use of this great opportunity in good measure.

Unproductive farms improved

Through the Service, both individuals and communities are provided, on request, with information on how to deal with their soil and water problems. There are many reports of how exceedingly poor farms have become productive to the point that the sons and daughters of their owners are easily sent to college.

Each district is a legally administered unit of the State Government, created at the request of local landowners and operators. It is responsible for local soil and water conservation, just as the county is responsible for schools and roads. It is run by a board of local people. A State Soil Conservation Committee established by State law has general direction of the districts' activities in each state. None of these bodies are branches or agencies of the Federal department.

Each district prepares a program which states the district's soil and water conservation goals and the methods required to attain them. Previously to this, local citizens have been consulted and technical information has been provided by the U. S. Department of Agriculture, State agencies, or other sources.

After the supervisors, as the people on the committee are called, have formally requested assistance and prepared the program, all agencies of the Department of Agriculture may assist each district with which it has a "basic memorandum of understanding."

Aid within easy reach

The Soil Conservation Service provides the services of professional conservationists without charge. For example:

If you are a landowner or a manager of leased land the odds are nine to one that your land is in a Soil Conservation District. Consequently, expert help is within easy call.

A detailed soil and land-capability map of your farm, or a range condition map of your rangeland, will be made for you, with specific information about the different safe uses, adapted crops, including grass, trees and wildlife, for each kind of soil you have. Technical services may be given for construction of dams, terraces and buildings; information on varieties of plants, seeding methods and rates; cultural practices for grass or trees, and management of pastures, woodlands or wildlife. You may hire equipment for earth-moving, for seeding, or for whatever you need to do, either with an operator or for rent on a cost basis. You will find the telephone number of the U. S. Soil Conservation Service or County Agricultural Soil Conservation Committee under County or U. S. Government Agencies.

The Federal Extension Service cooper-

U. S. Soil Conservation Service

STRIP CROPPING. Contour planting in alternating strips of grain and vegetables. A stretch of young plants only partly covering the soil is buffered on both sides by a heavy stand of mature plants. On the South Carolina farm pictured here, no erosion occurred during a 13-inch rain that fell in four and a half hours. The Soil Conservation Service furnished technical assistance in the planning and laying out of this rotation.

ates with land-grant colleges in furthering conservation education. There are many more possible tie-ups for assistance so that every kind of need of everyone seems to receive consideration.

Local administration of watershed problems comes under each district's jurisdiction. The Department of Agriculture assists locally with watershed protection and flood-prevention projects, supplying technicians, cost-sharing and credit. Each district can in this way provide the best possible plans for land treatment.

All of this is supported by State and County appropriations, by money earned by each district, and by private contributions. Costs of services on private lands are met by the owners. Cost of services for public benefit may be shared by the Federal Government through the Agriculture or Great Plains Programs. But technical services are free.*

Many other nations have studied the Soil Conservation Districts enabling acts of our States, as well as their accomplishments. These have been used as guides to develop their own conservation programs.

TREES HALT EROSION

In a seven-state program of reforestation initiated in the early 1930s, 92 per cent of the plantings have controlled erosion, according to an item in *The New York Times* of June 24, 1962. The report comes from the Tennessee Valley Authority, which has conducted a 27-year survey of newly established forests.

Private landowners, in 85,700 separate plots, have planted 512,000 acres with about half a billion tree seedlings. Public land totaling 80,000 acres also has been planted with young forest trees.

*Numerous helpful publications on soil conservation are available without cost from the Office of Information, U. S. Department of Agriculture, Washington 25, D. C. Among those issued in 1962 are Agriculture Information Bulletins 244 on "Soil Conservation at Home" and 255 entitled "That Land Down There"; also Picture Stories 138 on small watershed programs and 142 on conservation jobs on private land. A monthly magazine, *Soil Conservation*, is available at $1.50 a year from the Superintendent of Documents in Washington.

Pennsylvania Department of Forests and Waters

SCORCHED EARTH. Strip mining for coal in Pennsylvania over many years has left more than a million acres of land idle and unproductive, an ugly scar on the landscape.

SEEDLING TREES RESTORE SCARRED EARTH

ON May 13, 1962, the strip mine operators of Pennsylvania celebrated the planting of the 100 millionth seedling tree, to reclaim the earth that had been scarred by open-pit mining. The Pennsylvania Department of Forests and Waters has furnished 70 million of these seedlings since 1945, when the State's first law regulating restoration of stripped areas was passed. Other trees have been supplied by the operators themselves.

Every year approximately 10,000 additional acres are left idle by open-pit mining. Modernization of the State's forest tree nurseries has made possible the production of around 20 million trees a year. About half of these are being used on strip-mined areas, where they will eventually be a source of lumber.

RECLAIMED. A fine growth of forest trees here begins to cover the naked land.

Pennsylvania Department of Forests and Waters

PURE WATER AND SAFE SEWAGE DISPOSAL

"The love of Nature is aesthetics.
The understanding of Nature is science.
The management of natural resources is economics."

—*Aldo Leopold*

SAFE water supply and sewage disposal systems are vital needs to our expanding population. Our rivers and harbors can no longer take care, through Nature's alchemy, of the enormous amounts of human and industrial wastes which are the major health problem of our country. Just as the money is found for a child who needs an instant appendix operation, so it must also be found to provide adequate and safe sewage disposal, and thus clean up our rivers, lakes and harbors, and even extend our activity to keeping the ocean clean.

Dr. L. E. Burney, of the U. S. Public Health Service, calls pollution a national disgrace. "It is tragic," he says, "for the world's richest, most powerful and technologically advanced nation to foul its own nest, limit its own growth, and threaten the health of the people."

Many years ago typhoid fever, water-borne, was conquered (in part) by aeration and filtering of water supplies. We have since been proud of having safe water flow from every spigot. Today, however, the supply is not always safe. In many localities the practice of letting raw sewage flow directly into running water could cause a bad epidemic.

Our water supplies are further contaminated by harmful substances from oil, motor fuel, asphalt roofs, hardtop roads, detergents and other substances that seep into them. When extensively used, DDT and other toxic insecticides will also reach the ground water and thus endanger human health.

The greatest problem, still only partially solved, is sewage control. All sewage should be run through septic tanks or public plants for purification. The resulting liquids should be guided back into the soil through long absorption channels. Everywhere, today, the cleansing and re-use of all water should be part of water conservation procedures.

The articles immediately following point out some of the attendant problems and report the beginnings of solutions for them.—Ed.

RETURNING THE WATER TO THE GROUND

Home-owners' practices can be influential in halting fall of water table

WATER flows so freely from the faucets in nearly everyone's home that little thought is given to its source or its disposal. If the question were asked, "Where does our water come from?" some would say that most of it comes from the ocean; others that we get it from the ground. Both are correct.

What becomes of our water when it goes down the drain? The answer to that deserves the attention of every user of water.

The illustration of what is called the *hydrologic* (or *water*) *cycle* shows how water from the oceans is evaporated, minus its salt, into the earth's atmosphere.

There it forms clouds which eventually release it as rain, snow, hail or sleet. Some of this moisture runs into streams and back into the ocean. Some is used by plants in their growth, the excess being transpired from plant surfaces and drawn back into the atmosphere. Some of the water from streams, ponds and wetlands also re-enters the atmosphere.

Part of the water that falls on the earth seeps into the soil, where it eventually reaches the ground-water level. It is from here that wells derive the water that is pumped into houses and also used by industry.

Much has been said in recent years about the lowering of the ground-water level, called the *water table*. Over a large part of the country, particularly near cities and industrial centers, wells have repeatedly had to be lowered in order to reach the ground water; and in places, even deep down in the earth, the supply of water has been scant. A brief explanation is given in *Water*, The Yearbook of Agriculture, 1955*:

"The reason is that the underground reservoir is not a continuous, unlimited, freely moving body of water. Water is lost continuously from underground strata through natural outflow and seepage. It is replenished naturally only by water that percolates downward from surface streams, forests and fields. In years past, a condition of approximate equilibrium existed—the replenishment of the water table was equal to its losses. But the replenishment rate has been reduced by land clearing, drainage, grazing and cultivation; the withdrawal rate has been increased in many places by heavy pumping from wells. Whenever water is pumped

*"Water is Where the Irrigator Finds It" by William P. Law, Jr. and George M. Renfro, Jr., *Water*, The Yearbook of Agriculture, 1955, pages 333–340. U. S. Department of Agriculture. Available from Superintendent of Documents, Washington 25, D. C. $2.

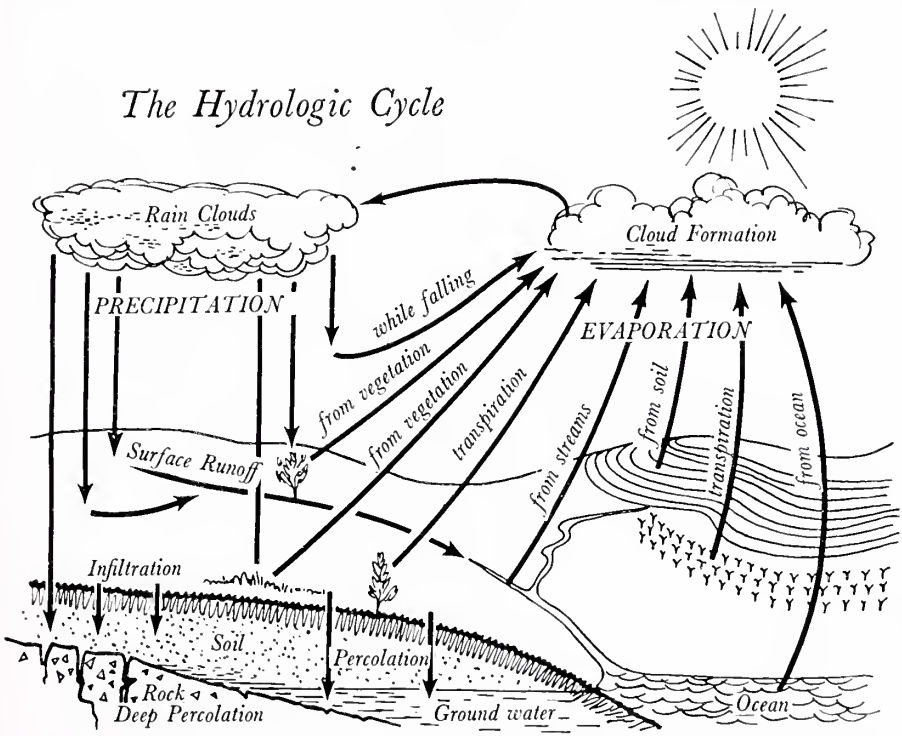


Illustration from WATER, The Yearbook of Agriculture, 1955

from an area faster than it can be replenished from surrounding areas, the water level is bound to fall."

Correcting the situation

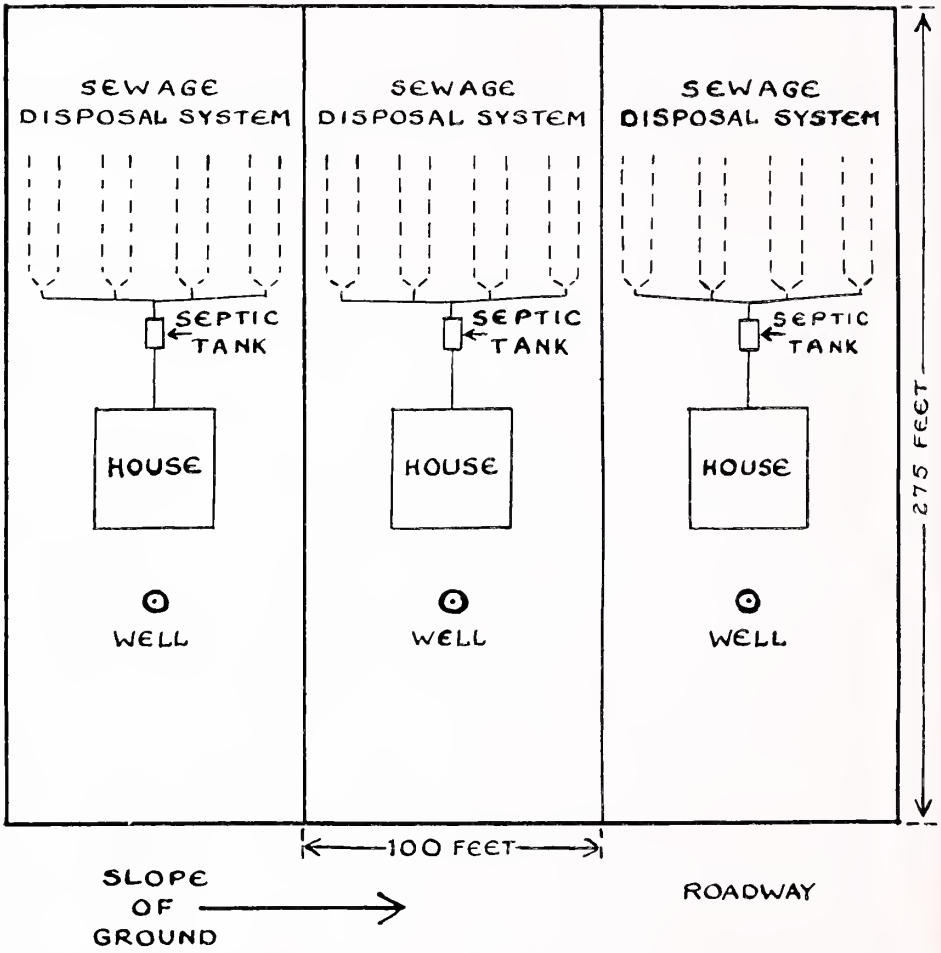
In places where there are no public water and sewage disposal systems, a practical solution to the problem of the falling water table is to return all possible water to the soil. Conserving water by being careful of its use, such as refraining from sprinkling lawns and gardens in rural areas, can also help appreciably, but the most long-lasting practice is to keep continuously replenishing the ground water.

Industries can do a great deal in this direction. On Long Island, for instance, whenever water from a well is used for a cooling process, it is required that the water be returned to the ground. Here it will percolate through the soil until it again reaches the water table, from where it can be used for repeated cooling processes as long as it replaces itself.*

Dangers in subdivided real estate

Any pure water that is returned to

*For figures on the amount of water used for cooling and for some other industrial processes in the United States, see the article on page 26.



GROUND PLAN to show correct location of wells and sewage systems on adjoining lots in communities where central water supply systems do not exist (see text page 23).
Adapted from "Water Supply and Sewage Disposal Systems in Realty Subdivisions" by David C. Wiggin.

the soil can be pumped with safety into homes for domestic purposes. But if any source of contamination is nearby, the situation may be critically dangerous. When land is subdivided, for example, into plots smaller than a quarter acre, the problem is bound to be acute. Even this size lot is by some considered unsafe, yet in some developments there may be ten houses to the acre.

In a crowded area, every private sewage disposal system may affect the water supply of several neighbors. State and local health departments are equipped to advise property-owners on the placement of their wells and sewage systems. In a special bulletin,* prepared by the Office of the Sanitary Engineer, State Department of Health, Hartford, Connecticut, it is pointed out that the well and sewage disposal system should be planned *before* the house is built. Factors which may affect their location, also the location of the house, include slope of ground, proximity to a neighbor's facilities, permeability of soil, level of ground water, planned height of house foundation, and space available.

While 75 feet is considered the absolute minimum of safety for the distance between well and sewage system, 100 feet is far preferable. In many circumstances, less than 100 feet may bring contamination into a household water supply. The accompanying sketch, which is adapted from the Connecticut booklet, shows the correct location of the wells and sewage outlets on three adjoining lots. For one home-owner to reverse the positions of the two facilities would endanger his own and at least one neighbor's water supply, especially if the land slopes.

The broken lines extending backward from the septic tank represent the drainage-tile field, through which the partially purified liquid outflow from the tank is carried into the ground, where it is eventually further purified by filtration. The bacteria of decomposition present in the septic tank perform only the first step in the job of purification. A large area is needed for this seepage, which takes place through the open joints of the tiles. It is important that the entire drain-field be far from any well.

*"Water Supply and Sewage Disposal at Realty Subdivisions" by David C. Wiggin.

Advantage of individual systems

Having one's own approved means of sewage disposal has an advantage over most municipal systems, in which all the wastes flow into rivers, which they contaminate, and eventually reach the sea. It is true that Milwaukee and other cities are processing their sludge, turning it into a useful product—a fertilizer—and releasing only purified liquids into bodies of water; but this method is still the exception. In the majority of places wastes are truly wasted—the organic matter in them, the liquids in which this is carried, and the dissolved minerals, which are vital to plant and animal growth.

When these liquids are altered by bacterial action and filtration through the soil, they again become useful. But if their mineral content, which is needed by crops, had been allowed to flow out to sea, it could only be replaced with fertilizers largely derived from other land.

By the time once-used water is pumped up in somebody's well, it is free of contaminants—if wells and sewage systems are all properly located. Erecting four houses on an acre is likely to bring sewage trouble, particularly in heavy soils. (Sandy soil is safer.) Two per acre should be the maximum permitted, according to the more lenient authorities; one per acre is considered a more favorable maximum. Some foresighted communities have wisely restricted new building lots to a minimum size of one acre, some to two acres. These sizes are in themselves a guarantee of a safe well-water supply. For most people they will also provide pleasant surroundings for their homes. Whatever the area, conservation of water wisely begins with the home-owner.

City of Milwaukee, Division of Sewage Treatment

SEWAGE DISPOSAL. In Milwaukee, where pioneering work has been done in turning city sewage into a useful product (a fertilizer for lawns and gardens), the waste material is treated in this big plant. Processing the sludge, instead of letting it run freely into rivers, goes far toward keeping city water supplies pure.

DETERGENT DANGERS

SYNTHETIC detergents have created increasing problems with water supply and sewage disposal since the end of World War II. At that time they composed only 25 per cent of the soap and cleansing products sold, but they now represent about 90 per cent of all such products used in the United States.

These detergents are petroleum-based and are called "hard" because they are not readily decomposed; bacteria cannot assimilate them. As a result, suds build up in the sewage. When this reaches groundwater supplies, suds come foaming out of household faucets. Other contaminants from the sewage naturally accompany the suds. For such areas, the installation of safe sewage disposal systems is essential to health.

But the hard detergents create other problems. When contaminated water is being purified for a public water supply, the presence of the undecomposed detergents upsets the process. Even when sewage is being treated for disposal or further use, hard detergents literally "gum up" the machinery. Soap, on the other hand, made from animal fats, is immediately attacked and destroyed by bacteria when it enters the soil as waste matter.

Other countries are forging ahead of us in recognizing these difficulties. While industry here is carrying on research on "soft" detergents, harmless cleansers of this type are already being made in England. Last spring, a bill was introduced in West Germany's legislature to make it unlawful to manufacture or distribute hard detergents.

Conservationists United for Long Island have taken a forward step in their own territory, where detergents are creating special havoc in water supplies. In distributing a warning of the dangers of present-day detergents, the organization has urged that the County Health Department ban the use of all synthetic detergents in an effort to save the underground water supply from pollution. Wherever such action is taken there may be a better chance of attention being given the sewage disposal problem and also of research on soft detergents being intensified.

PURE WATER A CHALLENGE FOR PROBLEM AREAS

AN island is bounded by its shores, and cannot take the expansion that is mistakenly called "growth." That is one reason why Long Island has been having particular difficulty in keeping its water supply pure. Quarter acres, even seven-plot acres, are frequently still supplied with individual wells and cesspools. All the water is drawn from the water-table, and all the wastes flow back, generally clean, of course, but how can all be thoroughly cleansed in such proximity? There is probably no way to get out the poison which we allow to get into the ground water.

The most fortunate thing that has ever happened to Long Island is the fact that local government officials, in a comprehensive report, have recently stated that a public sewage system is now on the way. It will take years to complete a plan that will reach every home on the island. Contour maps must be exact to determine the flow of sewage from every direction. One small mistake might endanger the whole system.

Projects of this sort are developing all over the country, but not fast enough. The women are helping, as they should, in what is our national housekeeping. One League of Women Voters group pressed the passage of an anti-pollution bill in Texas, against opposition, with the slogan "Beaumont is beautiful but it stinks."

Clean water and safe sewage disposal are likely to come only when individual citizens join forces to demand both.

POLLUTION OF WATER

Diminishing supply endangers health as waste water is reused

Adapted from the September, 1961, Monthly Letter of The Royal Bank of Canada

FEW if any problems are more closely woven into the fabric of our modern society than the control of water pollution. Clean water is essential to human life.

Amid our seemingly increasing ease and safety, amid the proliferation of comforts and gadgets to make physical life happier, the danger to life itself is increasing day by day as a result of pollution of our water supplies. Two hundred scientists from thirty-three countries met in Paris in 1960 to discuss the problem. They found that in some places water is being taken from the ground about a thousand times faster than it is being replenished by rainfall. As a result, the same water must be used over and over again.

The water passing down the St. Lawrence, drawn into domestic water systems and industrial plants, has been used and discarded by hundreds of cities. Distances between waste outfalls and water intakes are being wedged closer and closer together.

Pollution comes chiefly from two sources: human sewage and industrial waste. It endangers health, it steals our sports fishing and our bathing, it robs us of our shellfish foods and commercial fish supplies, it reduces property values, it makes our drinking water unfit for use. We ourselves are responsible for pollution of our water supplies.

Industry has for the most part assumed its responsibility faster than have municipalities. It spends many millions of dollars on waste disposal and in research to improve its methods. The chemical business in the United States is spending forty million dollars a year to control its wastes; pulp and paper manufacturers have invested nearly a hundred million dollars in treatment systems in the past decade, cutting their pollution per ton of paper to half of what it was.

But much more needs to be done. Though research people are constantly at work seeking better methods of preventing water pollution, ever new means must be developed to keep pace with our changing economy. Water is not something to be taken for granted. If we pollute it, we must repair our damage to the supply.

WATER USE INCREASES IN UNITED STATES

TO keep clean, cool and occupied, Americans today are using more water than ever before, the National Geographic Society has reported. In a dispatch from Washington published in *The New York Times* August 5, 1962, it is stated that water consumption by homes, farms and factories has jumped by 270,000 gallons a day, or 12 per cent, since 1956.

The largest amount of water is used by industry in the United States, the article explains. Industrial cooling processes, for example, account for more than half the water consumed. To produce a ton of finished steel requires 65,000 gallons; 200,000 gallons are needed in manufacturing a ton of rayon, and 600,000 gallons for a ton of synthetic rubber.

The second largest users are the irrigation farmers; third are individuals.

Such up-to-date conveniences and facilities as laundromats, dishwashers, garbage disposal systems, showers, sprinklers and swimming pools send billions of gallons of water down the drain every year. Waste takes toll of further billions. It has been estimated that even when New York City was suffering a water shortage during 1949 and 1950, approximately 200 million gallons a day were dripped away from leaky faucets.

While the nation-wide rainfall averages 30 inches a year, or ten million gallons for every person in the country, only 30 per cent of this is actually used by the people. Of the remaining 70 per cent, according to the report, part is used by growing plants and part is returned to the air by evaporation and breathing. The extremes of rainfall which figure in the 30-inch average are found in mountainous regions of Hawaii, which may be deluged with a foot a week, and Nevada, which has only nine inches a year.

In cities and in arid zones where the demand for water exceeds the supply, the task of supplying water is Herculean. The problem is being approached in several ways, the report continues. Chief among them are conservation, especially anti-pollution measures and the reuse of water; building of larger aqueducts, and conversion of salt water from the sea into potable water. Experimentally, attempts are being made to cover reservoirs and lakes with a film that will retard evaporation.

Governments and private industries alike are intensifying efforts to "unscramble" ocean water on an inexpensive basis. Success could open up a vast new resource, for the oceans cover three-fourths of the earth.*

"The idea of desalting sea water is not new," the *Times* dispatch concludes. "In 49 B. C., during his siege of Alexandria, Egypt, Julius Caesar produced fresh water for his troops with solar evaporators." The assumption is that the condensing vapor was collected by oiled silk or fabric screens.

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*It should be pointed out, however, that success on this scale is still far in the future. For a long time to come, it will remain the responsibility of every industry, every municipality, and every individual to practice conservation of water.—Ed.

FRESH WATER FROM SEA

THE people of Freeport, Texas, are now drinking ocean water, and liking it. The opening there in 1960 of the first plant for the desalting of sea water has raised hopes that our diminishing groundwater supplies in the United States may no longer be in danger. But the solution to one of the country's major conservation challenges is not as simple as that. Desalinization, even at the lowest recorded cost of 20 cents per 1,000 gallons (it is generally several times that much) is an expensive process in view of the 320 billion gallons of water used every day in the United States. The need to conserve or continue re-using our fresh water is obvious.

PHILADELPHIA'S GARDEN BLOCKS AND 4-H CLUBS*

An experiment in human restoration through which respect and dignity have emerged

Louise Bush-Brown

PHILADELPHIA'S Garden Block program has proved such a unique and vital force in neighborhood conservation and has had such an impact upon the lives of the people that it has received national and international recognition. Visitors have come to Philadelphia from every section of the United States and from several foreign countries to see and learn about this program initiated by the Neighborhood Garden Association. Similar projects have been started in Wilmington, Washington, Boston, and other cities.

The Neighborhood Garden Association of Philadelphia was founded in 1953, the purpose being to encourage and foster an interest in gardening and flowers in the blighted areas of the city and to awaken a sense of civic pride and fellowship through the organization of constructive garden projects for adult and youth groups.

The work of the association has been carried on as a cooperative endeavor by the settlement houses, the garden clubs and other sponsoring groups, and the residents on the blocks.

From a modest beginning in the spring of 1953 with the development of seven pilot Garden Blocks, each year has brought new opportunities for service to the Neighborhood Garden Association, and its areas of endeavor and its influence are being constantly extended. At the close of 1961 the records showed the following accomplishments:

301 garden blocks
15 vacant lot gardens
12 play areas on vacant lots
122 4-H Club individual project gardens
1,200 dooryard gardens in low-rent housing projects

Equally important is the change in the attitude of the people living there. The window boxes and flower bays have offered more than beauty; they have created a new vision for the mind and been a torch to the spirit, kindling a striving for a better way of life. Neighbors have learned to work together to improve their community; teenagers have learned to use their energies constructively; and adult and youth leaders have emerged.

In the spring of 1962 a new program was set up, known as the 4-H Neighborhood Improvement Program. This program is co-sponsored by the Neighborhood Garden Association of Philadelphia and the Agricultural Extension Service of the Pennsylvania State University under a grant of the Sears-Roebuck Foundation. Through this program a club will be eligible for a nominal sum to be used in carrying out its own neighborhood improvement project. This is the first program of its kind in this country.

A typical Garden Block, during its two years of sponsorship, is transformed from a shabby, litter-strewn street into a block in which the residents may take very justifiable pride. There are flower boxes at the windows, gay with petunias and geraniums, and there are little brick bays against the houses in which climbing roses or other flowers have been planted. Trash-filled vacant lots have been cleared and made into little flower gardens or, in some cases, into tot-lots for younger children. House fronts have been painted, and the street and sidewalks are kept clean and free of litter.

*Condensed from *The National Gardener*, Mar.-Apr. 1962, Bulletin of the National Council of State Garden Clubs, Inc. The slum area in which Mrs. Bush-Brown's project originated is comparable to parts of New York's Harlem.

MIANUS RIVER GORGE

How a threatened hemlock forest became a sanctuary

Gloria Hollister Anable

VIRGIN hemlocks of a size seldom seen today tower above surrounding trees in the gorge cut by the Mianus River. More than a hundred other kinds of woody plants grow there, and wildlife abounds in the area.

Until a few years ago, relatively few people knew of this scenic spot. Then suddenly it was coveted—but not for purposes which would respect its venerable beauty.

Today, however, it is a splendid sanctuary. The story of how it was acquired after being threatened and how it is now managed is told below by one of the staunchest of the backers of the movement to save Mianus.—ED.

THE Mianus River runs a crooked course from New York State into Connecticut, flowing into Long Island Sound between Greenwich and Stamford. In its northernmost section it has cut a deep gorge where some of the largest and oldest hemlock trees of the East are growing. This remarkable forest has been successfully saved from impending destruction, and is now preserved as a sanctuary.

Under the sponsorship of more than fifty garden clubs, Audubon societies and other conservation-minded organizations in Westchester County (New York) and Fairfield County (Connecticut), the area is managed and controlled by The Mianus River Gorge Conservation Committee. This, in turn, is affiliated with The Nature Conservancy of Washington, D. C., a national organization promoting similar projects all over our country. *The entire undertaking is privately administered, voluntarily supported and tax-exempt.* No support has been sought from Federal, State or Municipal Governments. It is a totally autonomous undertaking, governed by its own statement of conservation policies.

Interest in keeping the gorge safe from despoliation began in the summer of 1953, when four Stamford residents, Mr. & Mrs. Anthony Anable and the late Mr. & Mrs. Malcolm Edgerton, made an exploratory trip through the area. In December 1953 an evaluation group of professional conservationists, ecologists and naturalists, visiting there at their request, reported: "The Mianus Gorge is worth saving; it *must be saved.*" The Mianus River Gorge Conservation Committee was thereby formed.

In March 1954 came the first challenge to the gorge. A notice in a local newspaper stated that the New York State Water Power Commission would shortly hold hearings on an application of the Greenwich Water Company for permission to dam the river and impound a reservoir stretching northward almost to the gorge.

At the water company's hearing a compromise was worked out between the conservationists and the company whereby the height of the dam was limited and the company was enjoined against cutting any trees above this level of the new reservoir.

A few months later an even more serious challenge arose: a real estate developer wanted to purchase and "improve" 60 acres of the area, including the so-called "Hemlock Cathedral," for a development.

This challenge triggered immediate activity by the committee and its facilities. Only through actual land acquisition, they realized, could permanent survival be assured, so they secured an option to pur-

C. E. Mohr

HEMLOCK GORGE. Beyond these relatively young trees near the edge of the Mianus River gorge, there is a stand of the largest and oldest hemlocks in the region.

chase. Less than twelve hours before the option expired on January 2, 1955, the committee bought its first 60 acres, paying $30,000. The real estate development was forestalled.

An immediate goal of 100 acres was set, long since exceeded. Lectures, educational publications and intensive fund raising were expanded. To date 132 acres have been purchased and paid for in full. In addition 76 acres have been deeded by land owners, who are assured that their cherished land will be protected in perpetuity. From the date of its inception, the committee has received well over $200,000 in cash, securities and land, comprising a total of more than 3,000 gifts, evidence of a broad base of public support and dedication to the great cause of conservation.

Widespread publicity has accompanied the efforts of the committee: nine articles in national and sectional magazines; hundreds of newspaper notices and a dozen editorials by a sympathetic press; and an international institutional advertisement by a great New York bank. Two nationally recognized awards have lent stature and prestige to the project—the Silver Seal award of The National Council of State Garden Clubs in 1957 and the Founders' Fund award of the Garden Club of America in 1958. Visitors signing a book at the entrance to the trails totaled 2,290 for June, July and August 1961, with close to 3,000 for that calendar year, and a week-end high of 235 over the Independence Day holiday. People from far afield have visited and studied the gorge project as

The Mianus Gorge Natural Area
Visitors are welcome To Enjoy-But not to Destroy
Do not enter with gun, dog, ax, trap or fire
Please help preserve for the future
this heritage from the past.
The Mianus River Gorge Conservation Committee
of The Nature Conservancy

SIGN that greets visitors to Mianus Gorge.

a guide to their own efforts in other parts of the country.

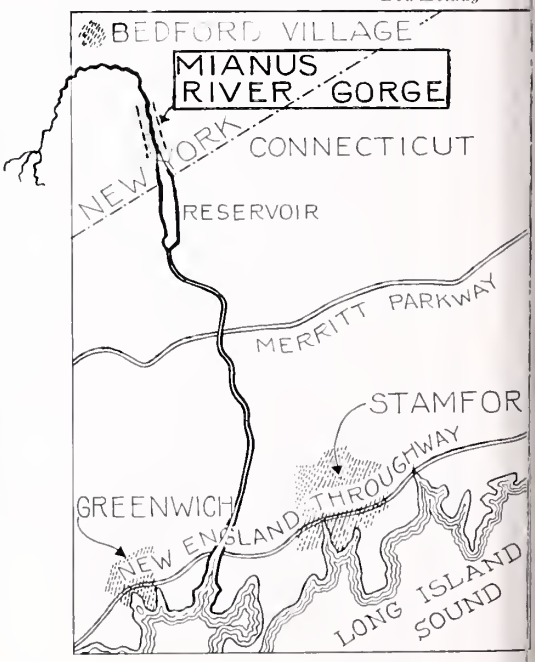
Fund raising and land acquisition continue, accompanied by consolidation and utilization of gains made as a solid foundation for the future. Three miles of foot trails have been marked. A rustic structure at the visitors' parking area carries a four-by eight-foot colored trail map. Appropriate conservation exhibits and literature are financed by the Founders' Fund award. Seven days a week in summer and on weekends and holidays in spring and fall, a warden-naturalist is on duty.

An initial publication, "Flora and Fauna of the Mianus Gorge," lists over 500 species of trees, shrubs, vines, wild flowers, ferns, lichens, mushrooms, birds, mammals, reptiles, fishes and amphibians observed in the area. A grant from The Charles Lathrop Pack Tree Foundation has financed a study and labeling of specimen trees, shrubs and vines by the Yale University School of Forestry and members of the Mianus Gorge committee. An herbarium of these species is on display at the Stamford Museum and Nature Center. Surplus funds, totaling $25,786 on January 1, 1962, have been invested in an endowment fund, interest from which eventually should largely finance maintenance and protection. Each month $500 is added to this fund, the immediate goal of which is $100,000. Cash and security donations, chiefly from former contributors, are currently coming in at the average rate of $12,150 each year.

What has been accomplished at Mianus Gorge can be accomplished elsewhere, given certain essential ingredients of success. First of all, there must be professional assurance that the proposed area is worth saving. Next, at least one energetic, dedicated individual is needed to inspire and to work almost full time, also to set up an equally dedicated committee to handle the complexities of finance and accounting, fund raising, legal work and land evaluations, publicity and trail management. Next, a genius to arouse widespread public interest and to portray an appealing image of conservation is essential to encourage financial support. Finally, an affiliation with a national conservation organization providing tax-exempt privileges and high-level professional guidance for lay groups is highly desirable.

The Mianus Gorge Conservation Committee and its parent organization, The Nature Conservancy, are eager to share their knowledge and experience with similar groups so that what has been done in this area may serve as a guide for accomplishment elsewhere.

Eva Melady



HAWK MOUNTAIN

Maurice Broun

Rosalie Edge

HAWK Mountain lies atop the Blue Mountains of eastern Pennsylvania. The Indians called this chain the "Endless Mountain"—a fold of the land, smoothed by the sea that once submerged it. East of Hawk Mountain, however, there is a break in the chain, and a wide valley cuts through, on the west of which rises the escarpment of Hawk Mountain, and the Sanctuary's Lookout Rocks. It is here that our story begins.

The migratory hawks and eagles for ages have known all about this and, buoyed by the thermal currents rising on either side of the level-topped mountains, have sailed effortlessly southward on their autumn migration, unobserved for the most part above the forest. But they come into full view flying across the valley to the east of the Sanctuary Lookout Rocks—and a magnificent sight this is when the autumn winds bring the great birds across the valley. So, for fifty years or more up to 1934, gunners congregated on the rocks, and shot the hawks wantonly and mercilessly. No bird was retrieved, for what good is a dead hawk? The game was to kill, or to maim, leaving the suffering winged creatures to die. Great sport, thought many hunters.

The place was a shambles. At this scene, however, there arrived, in 1932, two young conservationists, Henry Collins and Richard Pough, afterwards distinguished authors of ornithological books. They publicized the facts, and the land was quickly acquired, 1,399 acres, through the agency of the Emergency Conservation Committee, at that time the most active and far-seeing conservation group of the United States. This is Part II of our story.

Part III opens with the establishment of Hawk Mountain Sanctuary in 1934, the arrival of Maurice Broun as Curator, and the coming of a veritable host of friends of wild creatures to enjoy the marvel of migration so dramatically displayed.

The Hawk Mountain Sanctuary Association was incorporated under the laws of the Commonwealth of Pennsylvania in 1934, and is, we believe, the only organiza-

To reach Hawk Mountain Sanctuary by car, take Route 22 to Hamburg, Pa. This will bring you within a few miles of the sanctuary. At Hamburg information is easily acquired, and road signs will direct you. For further information address: Hawk Mountain Sanctuary Association, Route 2, Kempton, Pennsylvania, or The Office of the President, Hawk Mountain Sanctuary Association, 767 Lexington Avenue, New York 21, N. Y.

tion dedicated especially to the conservation of the predators, bird and animal. The mere protection of the predatory birds and animals, however, which on the sanctuary no longer need protection, did not satisfy the directors nor Dr. Broun. The directors and the curator at once took up the task of conservation education. The public thronged to the sanctuary. Dr. Vernon Bailey called it the "School in the Clouds." Dr. Broun's lectures and nature walks at the sanctuary have interested many thousands of children and adults in conservation of wildlife and in the habitats of wild creatures. The sanctuary is ideal for this purpose, and has become a veritable laboratory under this inspired and enthusiastic teacher.

But, alas, all predators are in danger. The ignorance of men and the disappearance of habitat, because of overpopulation, are responsible. The American bald eagle and the golden eagle are in imminent danger of extinction. Except in Alaska, looking skyward, we may soon see our national emblem reproduced in metal only, on the tops of flagpoles. The decline in the numbers of hawks is notable and obvious. Let us remember that: "The time to save a species is while it is yet common," and renew our efforts for state laws to protect the predatory birds.

And Part IV? Who can tell what next? A generous bequest has enabled the association to extend its educational work beyond the confines of the sanctuary, to schools and clubs, to sportsmen, churches, and to all who will hear the message. This work is under the direction of the Field Extension Secretary, Robert Compton. The horizon widens, the prospects brighten.

Editor's note: Both the Emergency Conservation Committee and the Hawk Mountain Sanctuary Association, which Mrs. Edge mentions in her article, were founded and carried on by her own tremendous vitality and ability.

ALBATROSS IS SAVED

The Laysan albatross, a creature of comical antics, known as the "gooney bird," endeared itself to many Navy men during their service in the Pacific. Yet, when the United States Naval unit stationed on Midway Island discovered that it was endangering planes, plans were made to eliminate the entire colony there. The birds, nesting in vast numbers on and near the runway, were frequently in flight when planes were taking off. Neither sounds of gunfire, distress calls, nor ultrasonic tests would induce them to leave their nesting site.

Widespread public protests in 1960 halted the Navy in its proposed course of slaughtering the colony. The U. S. Fish and Wildlife Service studied the problem and recommended clearing vegetation and leveling the dunes along the runway. A 67 per cent decrease in the number of albatrosses flying over the runway resulted. The clamor of the people, made up of individuals' voices, saved a species of bird from near extinction.

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THE WHY AND HOW OF NATURAL AREA PRESERVATION

Long Island Chapter of Nature Conservancy provides examples of land acquisition through concerted action and gifts

ALL over the country, natural areas are being set aside as sanctuaries, living museums, research tracts, study plots for schools, watersheds, and for other purposes. These preserves, on the whole, are established so as not to be altered through man's manipulations over the long-term future.

Many of these areas are being set aside through or by The Nature Conservancy, whose headquarters are in Washington, D. C.* A leading purpose of this national membership society is to insure the preservation of ecologically important sites.

The story of the Long Island chapter, one of the largest and most active branches of The Nature Conservancy, gives an insight into some of the reasons why groups like this are aiming to protect priceless remnants of our natural landscape. By example, it also shows, in brief, how natural areas are sometimes acquired.—Ed.

*2039 K Street, N.W., Washington 6, D. C.

Eugene T. Mudge

IT is estimated that the major topographical features of the 723 square miles of Long Island were laid down during the final phase of the glacial epoch, over a period of about 115,000 years. It is also estimated that if all the bulldozers, chain saws, and dredges now on the island were to operate continually for a decade, they could make Long Island flat and lifeless as Bonneville Flats. This, of course, is an exaggeration. But it is no exaggeration to state that all of us are witness to the daily destruction of valuable areas throughout the island. Herein lies the raison d'être of the Long Island Chapter, Nature Conservancy. The unit was launched in October 1954 under the the leadership of Dr. Robert Cushman Murphy, retired Lamont Curator of Birds at the American Museum of Natural History. By 1954 the physical features of Long Island were undergoing an increasingly rapid transformation. Housing developments, road construction, and land-fill operations for industry were factors in the destruction of natural areas of great beauty as well as biological value. The famous and extensive Hempstead Plains in central Nassau County, unique in flora and bird life, had already disappeared in the housing boom which followed World War II.

Those of us who appreciate open space, and deplore the destruction of woodlands and marshlands, became alarmed. Time was running out. In the decade of the 1950's the population of Suffolk County was expected to triple; the population of Nassau County would double. Several large areas of great importance had been saved by governmental action, notably Montauk Point and the Jamaica Bay Refuge. But what of some of the smaller areas? Could we save some of these for the use and enjoyment of succeeding generations, especially those with a variety of ecological characteristics? The answer is the record of the Long Island Chapter.

The first preserve to come under the pro-

What Are Natural Areas?

NATURAL AREAS are portions of the untouched landscape in which associations of plants and animals (*"biotic communities"*) can exist free of man's disturbance.

What are the values of natural areas when set aside as preserves? From a naturalist's point of view, the answer should be obvious, since all forms of life which have spent millions of years evolving are worthy of preservation in their own right. On the other hand, in our industrially oriented society can natural areas defend themselves?

When biotic communities are established as natural areas so that they may be preserved without interference by man, they serve as living museums for both adult and youthful visitors. In addition, they furnish the benefits of any undeveloped segment of landscape: relief from urban stress and strain and an opportunity for people to become closely acquainted with the living world of which we are a part. Especially can our youth of today observe at first hand in these natural communities some of the basic biological problems confronting mankind. What students can learn about the balance of nature and the results of overpopulation can be readily applied to our human community.

The role of natural areas in serving as watersheds cannot be over-emphasized. The biotic communities of our tidal marshes are the vital key to the multi-million-dollar coastal fishing and related industries.

These are but some of the values of natural areas. Whether their worth is aesthetic, scientific, educational, historical, or industrial, there is good reason to protect them from destruction without delay.—WILLIAM A. NIERING

tection of the chapter was Smoky Hollow Bog at Fire Island Pines, a few miles east of the Sunken Forest. (The dramatic fight to save the famous Sunken Forest on Fire Island is told in an accompanying article.) This bog, although not large, contains an outstanding flora: rose pogonia orchid, gerardia, ladies-tresses, cranberry, sphagnum moss, sundew, sheep-laurel, azalea, blueberry, white violet, and Labrador-tea. The land was a gift of the owner, Dr. Warren Smadbeck, President of the Home Guardian Company of New York.

The following year, in 1957, the 125-acre Hoyt property near Commack was given to the New York Council of the Boy Scouts of America.

Through the influence of The Nature Conservancy, about one-half of this property has become an inviolate nature preserve and study area. Its low, rolling hills and kettle holes form the northern boundary of the pitch-pine barrens in the center of the island.

Wolf Swamp Sanctuary, comprising twenty acres of swampy and upland second-growth woodland and over a quarter of a mile of lake shore, is a few miles north of Southampton on Lake Missapogue. This land was also a gift.

Kings Point Pond at Kings Point, Long Island, a shallow fifteen-acre coastal pond, of value as a waterfowl resting area, was turned over to Conservancy by a group of local residents who will preserve it in its natural state under the supervision of the chapter.

Another gift was the fifteen-acre tract known as Delafield Woods, a mature second-growth woodland area in the Nissequogue section of Smithtown. This land has a rich understory of trailing-arbutus, pink lady-slipper, mountain-laurel and blueberry.

A few miles away in St. James are the Butler-Huntington Woods, a sixty-six-acre preserve of unspoiled rolling woodlands, a memorial to the mother of the donors.

The most recent acquisition, also a gift, consists of thirty-one acres of salt marsh and sedge, adjacent to Captain's Neck Road in Southampton. This property is known as the Ruth Wales du Pont Wildlife Sanctuary.

The acquisition of property is not the sole aim of the chapter. There are many areas where its influence has been or will be felt in the promotion of proper conservation principles: Kings Point Park, Douglaston Marsh, Appleby Beach in Glen Cove, the Marshall Field area in Lloyd's Neck, Flax Pond in Crane Neck, and Riverhead Bog. All the preserves may be visited and studied by qualified persons.

If it were not for the concerted action and success of The Nature Conservancy, some or all of these permanent nature preserves might now be feeling the weight of the bulldozers. Whether we realize it or not, all of us are a little poorer whenever we lose any part of our natural heritage.

SWAMP PARADE. The roots of cattails form a spongy network which helps to hold water in reserve; when growing along the banks of streams, they resist erosion.

Grant M. Haist from NAS

Built-In Flood Control

THE destruction of wetlands—swamps, marshes and bogs—by the filling or draining which is so often a part of both agricultural and urbanization processes, seriously reduces the water-holding reserve that is a natural part of the landscape. The water-holding capacity and the flood preventive value of these wetlands are phenomenal. A six-inch rise on a ten-acre marsh places 1,500,000 gallons of water into storage. Wetlands are the cheapest built-in flood control and water supply facilities.—WILLIAM A. NIERING.

THE SUNKEN FOREST

Eva Melady

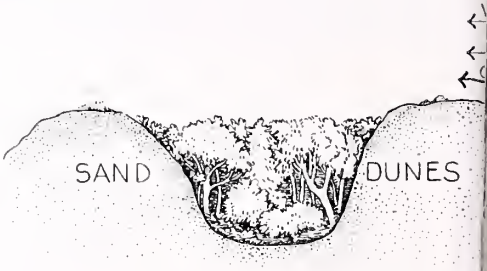
James N. Dunlop

BETWEEN the Atlantic Ocean on the south and Long Island's Great South Bay on the north lies a 25-mile stretch of sand known as Fire Island Beach. This is the southern barrier beach of Long Island. The whole strip is scarcely a quarter-mile wide. The ancient dune which forms its central ridge reaches a maximum height of 35 to 40 feet above sea level about half a mile east of the summer colony of Point O'Woods. Here a primeval forest, in which holly (*Ilex opaca*) is the predominant tree, has grown out of the sand. This is the Sunken Forest, perhaps the greatest natural wonder of the Long Island region.

In the Sunken Forest the salt-laden ocean winds have kept the size of all trees down to the maximum height of the protecting ridge. The trees have responded to this limitation by multiplying their topmost branches, so producing a heavy canopy of green above and deep shadow below. As one approaches in the usual way from the ocean beach one crosses the ocean dunes and the interdune swale. Finally, after surmounting the central ridge, one plunges downward beneath the surface of a sea of green. The forest is called "sunken" not because it is below sea level but because it does not rise above the upper level of the central dune.

This primeval woodland contains not only holly but, in order of decreasing abundance, tupelo gum, sassafras, wild cherry, oak, pine, cedar, maple; also many shrubs, such as shadblow, which emulate the trees in size and vigor, highbush blueberry, bayberry, and beach plum. There are many lesser plants of which two are especially worth mentioning: bearberry, which provides most remarkable ground cover in sunny areas and seems to ape the holly with its glossy dark green leaves and its scarlet berries, and wild sarsaparilla, which in the early season spreads a veritable carpet of vivid green.

The singular charms of this forest include glades of densest gloom pierced here and there by scintillating spears of light. Trunks of sassafras trees twist like brown serpents through the foliage; cat-brier and poison-ivy climb with liana-like effects. Above all is the unique glory of the hollies. Swamp and beach vegetation and the wealth of bird life complete the picture.



Eva Melady

ATLANTIC OCEAN winds blowing across the dunes of Fire Island keep the trees of Sunken Forest "trimmed" to the level of the highest dunes.

While the origin and development of this forest are of course without historical record, its recent annals began in 1951 in an alarming way when the owner of about one half of its area advertised the sale of that part in building lots at public auction. The day before the sale the auction was forestalled by the purchase of the property by three friends of the forest. Then followed another peril when a plan came under discussion for the development of the same area in acreage plots. Meanwhile the danger to the forest had come to the attention of the Conservation Department of the American Museum of Natural History, which alerted a student of conservation at Yale University. He took the Sunken Forest as his thesis. Simultaneously a campaign was started to purchase the three plots forming the Sunken Forest proper, so that they might be taken out of the real estate market. By the fall of 1952 a sufficient sum had been secured to purchase the most westerly of the plots and to obtain options on the other two.

Meanwhile in 1952 Mrs. James N. Dunlop, a member of the Women's Committee of the Museum and a summer resident of Point O'Woods, was drafted to help save the Forest. Almost immediately afterward, Mr. Dunlop was asked to join the campaign, and in 1953 they became co-chairmen of the fund-raising committee. They rushed in with great enthusiasm and not a little of the never-say-die spirit. Before the two remaining parcels of the forest proper were acquired, the co-chairmen addressed themselves to a new problem—that of securing the three parcels of land between the forest proper and Point O'Woods, lying only about one third of a mile to the west. It was evident that the forest preserve would gain immensely by being anchored to a stable community like Point O'Woods. Three more prolonged negotiations with owners had to be undertaken and three more large sums raised.

These negotiations produced a plentiful crop of difficulties, legal and otherwise, with the usual alternations of hopes and fears. With the help of innumerable gifts of all sizes (ranging from 18 cents from two young children to $26,000), the necessary funds were found. By February 1955 all of the Sunken Forest prop-

American Museum of Natural History

TOP OF THE FOREST. Concentrated terminal growth on the wind-trimmed hollies makes a solid canopy of green over Sunken Forest and the adjacent dunes.

er and two of the three intermediate parcels had been secured.

In May 1955 the co-chairmen, with the help of the warm friendships which had developed during the campaigns, organized the Sunken Forest Preserve, Inc., as a non-profit membership corporation under the New York State Laws to hold the real property acquired as a wildlife sanctuary and for charitable and educational purposes.

At the end of June, 1955, this corporation took title to all of the five parcels of land just mentioned. Almost immediately plans began to take shape for the purchase of the last remaining parcel between the property owned by the preserve and Point O'Woods. This was accomplished in 1956.

In the course of acquisition of three properties it had been necessary for two purchase money mortgages to be placed on them in the aggregate sum of $48,000. By October 1959 both of these had been paid in full, the last one two and one-half years before its due date. So the long journey has reached a happy ending.

To sum up: A total of $135,000 has been raised and 75 acres of land have been acquired, divided about equally between beach and wooded land. The preserve has a half mile of frontage on a fine ocean beach and slightly less on Great South Bay. The wooded area includes the heart of the Sunken Forest.

On August 13, 1960, in the serene period that followed these events, the Sunken Forest Preserve was formally dedicated in a ceremony at the Community Church at Point O'Woods. Immediately after, a plaque was presented to the Dunlops to commemorate their work in preserving the forest from destruction.

The only sources of revenue of the Sunken Forest Preserve are membership dues and donations. These must be used not only to maintain the guardian organization, but also to protect the forest from fire, depredation and vandalism. With a steady increase in the surrounding population, these are ever-increasing dangers.

American Museum of Natural History

THE FOREST FLOOR. Holly, sassafras and sour-gum trees grow around a woodland pool in Sunken Forest.

WHAT OTHERS HAVE DONE ABOUT NATURAL AREAS

PEOPLE working together in the interest of nature preservation provide the force that makes it possible for some of the last remaining wild lands of our country to be saved from destruction. "The man with the gun is not the main danger today," wrote Henry Hill Collins, Jr., in *The Bird Watcher's Guide*. "Today's main danger is the man with the bulldozer."

Here and on the next few pages are briefly told the stories of how foresighted and generous individuals and groups have been responsible for saving precious parcels of land from the menace of the bulldozers. A suggested course of action for other groups to follow in launching conservation projects is given next, and on page 64 is a list of national conservation organizations which can offer guidance to those who wish to embark on similar projects. Conservationists United for Long Island, Box 536, Setauket, New York, will also help by giving information about local developments to anyone who inquires.—ED.

HOW APPLEBY BEACH WAS SAVED

William J. Brookes

APRIL 13, 1960, was my lucky day. I read in a local newspaper that the City Council of Glen Cove, Long Island, had voted to acquire a world-famous Long Island geological locality for a municipal park.

Appleby Beach is a short stretch between Morgan Memorial Park and the Hempstead Harbor Yacht Club on the north shore. It has a fine exposure of the hard-to-find Cretaceous clays containing the lignites and fossil leaf shale rocks that show some of the earliest known flowering trees to evolve on the face of the earth. Glen Cove was one area where these trees grew. It is practically the only accessible beach where collectors can find specimens to show to students and geologists. Yet upon the recommendation of the Long Island Park Commission, it was in danger of being acquired for recreation purposes, with a picnic area on the sixteen acres atop the bluff. I had already urged The Nature Conservancy to investigate the need to preserve. Now the danger signal went up.

At once a campaign was initiated to inform the public of the fact that a nature preserve must take preference over a picnic area. We formed a lively committee with representatives from every nature group available. We apprised Mayor Suozzi of the true importance of the property. He had not known of it, and promised his help. We attended a meeting called to condemn the property, to meet the opposition; much money was already being spent to acquire various sites. We told the Glen Cove citizens that this beach was of concern to the whole metropolitan area. From somewhere came the suggestion that Nassau County could make it a nature preserve.

We spent every evening and week-end in making telephone calls and in gathering information as to who must be persuaded and who might do the persuading. The campaign mushroomed.

Every nature group was asked to lend us its address list. We were never turned down. We sent out some 2,000 letters in

May and June. So many letters in response appeared on the desk of Mr. A. Holly Patterson, the County Executive, that we were assured Mr. Patterson would recommend acquisition of the site. By midsummer we learned that the County Public Works department had been assigned to survey the area to determine exact recommendations to be made to the Board of Supervisors.

Then it became a matter of follow-up. Various organizations and individuals helped to meet the expenses of the committee, such as mailing costs. A public hearing was held. Immediately after it, the Board of Supervisors voted to acquire Appleby Beach as a natural history preserve.

There remain many problems to be ironed out and adjacent land to be acquired, but we now have hope that this precious beach may be forever the gathering ground of teachers, students, scientists and nature lovers.

PROBLEMS OF GLEN HELEN

Friends of this natural area in Ohio achieve double victory against destructive public works

1929. From the Deed of Glen Helen Memorial

"Know all men by these present . . . that I, Hugh Taylor Birch . . . having in mind the scene of my youth . . . tramping through the wooded glen . . . in enjoyment of its natural beauty . . . and being desirous of establishing a memorial to my loving daughter, Helen Birch Bartlett, through the preservation of these woods, cliffs, springs, streams . . . [as] a preserve for birds, fish and game, wild flowers, trees . . . and as a campus . . . for . . . the purpose of Antioch College . . . do hereby give . . . the following described real estate . . . to have and to hold the same to the only proper use of the said grantee, Antioch College, and its successors forever. . . ."

The 920 acres of this beautiful area have since served students in public schools, organizations, churches, youth and recreation leaders, teachers desirous of learning Nature's language, college and university staffs and students, garden clubs, Audubon societies, conservationists, naturalists and

GLEN HELEN—a winter scene

Axel Bahnsen

other field scientists, artists, photographers, families attracted to the Trailside Museum, civic leaders for the Christmas Tree Festival at the School Forest, and more.

October 21, 1958

To all Friends of Glen Helen:
To Advocates of Parks, Camps, Forests and Nature Preserves:

A 300-foot dual highway is planned through Glen Helen and the Yellow Springs School Forest. . . .

We need the testimony of widespread public opinion. Write Governor O'Neill of your concern for Glen Helen. . . .

Letters poured in. A new governor followed.

April 9, 1959

"Threats that Antioch College's Glen Helen and Ohio's Bryan State Park would be violated by a proposed improvement and rerouting of U. S. Route 68 were ended yesterday by Governor Michael V. DiSalle."

Shortly after this threat was overcome, the committee learned of village plans to install a sewage disposal system in Glen Helen. Again the Committee to Save the Glen rose to the challenge. Protest meetings were organized, money was raised for the campaign, and substitute land was contributed. The Village Council installed the sewage system outside the glen. The committee was one of two non-profit groups given awards in 1961 by American Motors Corporation for their conservation work.

Axel Bahnsen

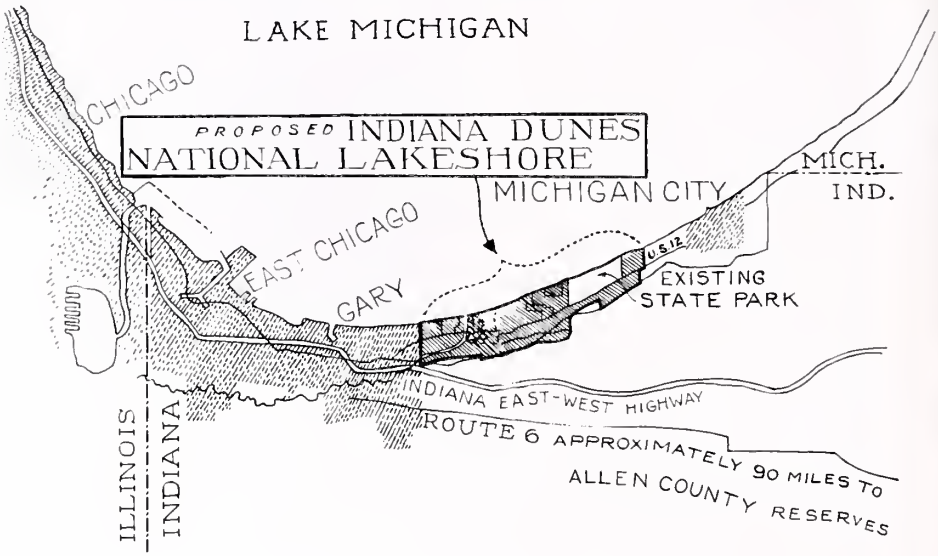
LESSON IN THE GLEN—a children's class

From the Journal of Henry David Thoreau:

"Each town should have a park, or rather a primitive forest, of five hundred or a thousand acres, where a stick should never be cut for fuel, a common possession forever. . . . Let us keep the New World *new*. . . ."

TRILLIUM TRAIL. Two garden clubs in the vicinity of Pittsburgh rescued one of the country's finest stands of *Trillium grandiflorum* by purchasing this 35-acre tract, now called the Fox Chapel Wild Life and Flower Reservation. A competing purchaser had planned a housing development for the area.

INDIANA DUNES AND ADJACENT AREAS



AS heavy industry expands it requires more land, and the shore of Lake Michigan, adjacent to Chicago, seems to be a coveted spot. A deep-water port is one of the projects. Plans of the Army Corps of Engineers and the Indiana Port Authority "would hopelessly destroy this irreplaceable wonderland of nature," according to E. J. Dissette, President of The Prairie Club of Chicago at 38 South Dearborn Street.

"Unlike most sand-covered earth dune formations," says Mr. Dissette, "Indiana's dunes, many of which tower upward 200 feet or more, are composed entirely of sand. These dunes extend inland a mile and a half before they are stabilized by vegetation. Some of them migrate, shifted by the prevailing westerly winds that blow off Lake Michigan, moving as much as sixty feet a year. Hence they are often spoken of as the 'Wandering Dunes.'

"Between the fore-dune, just off the lake, and the vegetation-covered inland dunes is an outdoor laboratory which botanists have called a 'storehouse of a lost world,'" Mr. Dissette continues. "More than 1,000 species of plants thrive on the sandy slopes or in the swales that lace the inner dunes. Plants native to the four corners of the continent coexist in unusual rapport on the dunes. Here one may find the prickly-pear cactus hobnobbing with the bearberry of the Arctic.

"Nearly hidden by the luxuriant fern undergrowth is a quaking tamarack bog, concealing botanical treasures that can be traced to the Paleozoic age. About 300 species of birds, ranging from the bald eagle and blue heron to the chickadee, nest here or pause during migration."

Industry has swallowed up all but a few miles of this unique dune region. If dredging is allowed to start, the dunes and their rare combination of plants and animals will be gone forever.

Carl Sandburg has said*: "The Dunes

*In a quotation that appears in the *Audubon Magazine* for July-August 1962, with an article by Senator Paul H. Douglas entitled "There is Still Time to Save the Indiana Dunes."

are to the Midwest what the Grand Canyon is to Arizona and Yosemite is to California. They constitute a signature of time and eternity: Once lost the loss would be irrevocable."

Forty years ago, United States Senator Douglas from Illinois has pointed out, there were 25 miles of unparalleled beach and dune area between Gary and Michigan City, Indiana. Today there are dunes in Indiana State Park, whose 2,100 acres were acquired largely by voluntary contributions, and there are dunes in one four-and-a-half-mile stretch of water front. Directly behind these is land either owned by big steel companies or under option by real estate developers. This is the last remaining area of the natural wonderland that is the Indiana Dunes.

Among the local organizations working to preserve the dunes are the Izaak Walton League of Porter County, Indiana, and the Save the Dunes Council, of which Mrs. J. H. Buell, 1111 Ogden Dunes, Gary, Indiana, is president. Inquiries about what individuals and groups can do will be welcomed.

Adjacent native habitats

While the above organizations are pressing for a National Park to be created in the Indiana Dunes, others are working locally to save whatever areas they can from destructive developments.

The Prairie Club

BORDERING LAKE MICHIGAN. The Indiana dunes have a beauty all their own.

The Prairie Club

INDIANA'S DUNES. Only a small part remains. To keep the remaining ones safe from the inroads of industry, efforts are being made to establish a National Park along the lake shore.

Spurred by their volunteer work for the dunes, a group of citizens farther east has banded together to preserve natural lands in northeastern Indiana. "ACRES" (Allen County Reserves, Inc.) is the name under which they operate, with headquarters at 2224 St. Joe Boulevard, Fort Wayne, Indiana.

"It was the realization that citizens had a job to do in every community that started the wheels for ACRES formation," writes Mrs. Thomas E. Dustin, a board member. "Time was wasting and we could not sit still and wait for county, state and federal governments to do the job. So in the fall of 1959 a handful of local dunes fighters gathered to lay the groundwork for ACRES with specific goals of acquiring, for permanent preservation, areas of native habitat in northeastern Indiana."

On the new organization's board were three naturalists, a lawyer, a surveyor, a public relations counselor, and the local soil conservationist, all of whom contributed their talents to the program ahead. Membership campaigns, field trips, films, lectures, publications, and a newspaper column all helped toward the goal.

Land has been contributed and some of it is already opened as a woodland reserve and living museum. Purchase of more land is in prospect. Foundation grants are helping with expenses.

SAVING OLD TREES, PLANTING NEW, HELPS KEEP WEST GREEN

Lively program carried out by volunteers beautifies cities, improves the land

PEOPLE in dozens of towns and cities across the West are taking action on their own to save old trees and gain new ones in downtown areas and in the suburbs —trees to shade pavements—trees to clothe naked land—trees to cover hillsides—trees to stand on skylines.

This is the way that *Sunset* magazine* introduced a prominent feature entitled "Let Us Have Trees." In each of its three editions, inspiring examples of tree planting for civic beauty and betterment were reported.

The Northwest edition tells of Klamath Falls, whose merchants planted sixty-nine trees on Main Street. At two new junior colleges 875 miles apart, neighbors pitched in to plant trees on bare campuses. Seattle spruced up with trees for the World's Fair. Ellenburg planted more trees than one can count.

Oakridge, Oregon, is a logging and sawmilling town of 2,500 at the upper end of the Willamette Valley. For nine years, the community has staged a tree-planting festival in conjunction with the towns of Willamette and Westfir. Two thousand persons plant cutover land each year with Douglas fir saplings made available by the U. S. Forest Service.

In the Central edition of *Sunset,* one reads that in San Francisco it is considered that nothing else dignifies a community as do trees. Here, the West has begun to plant trees by thousands in downtown areas, on residential streets, on hillsides, along highways. At the same time, the good news comes that healthy old trees are being saved.

The people are doing this for two main reasons: One is that in many places the bulldozer has flattened the land so that only trees can restore a look of nature and repose. The other is that people travel more, coming home to say: "Why isn't San Francisco more like Paris, or Seattle like Stockholm?" The obvious answer is the need of downtown parks and tree-shaded boulevards. Even children fight to save the old trees, as one group did in Orinda—an old redwood. The grown-ups are not behind. Actually, in Sacramento, land developers and road-builders forced a neighbor NOT to cut down an oak tree. It was sound, and with use of reflectors, not a traffic obstruction. Service clubs and garden clubs, everybody everywhere, seems to have caught the wonderful contagion of planting—and loving—trees.

The same story holds for Southern California. Los Angeles Beautiful is a star to steer by. In El Cajon, Boy Scouts and Girl Scouts in a single day planted 5,000 trees along Fletcher Parkway. The Lions Club bought 11,000 trees and offered them free. They planned the giveaway for a two-day period, but it took exactly five and a half hours to clear them all out. In Riverside, unwatered trees were dying of drought. A garden editor asked Riverside home-owners to drill holes three feet deep beside sick trees, fill the holes with gravel, and drip water down the holes for eight hours every three weeks. The byword became, "Seventeen cents can save a tree," because 750 gallons of water, at that price, were enough to soak a large tree's root area three feet deep.

The California Roadside Council, Inc., has carried out another splendid project, as told in its handbook: "More Attractive Communities for California." Some of the chapter headings are: "Must Growth Destroy Beauty?" "An Attractive Community is up to You," "How to Begin," "How to Make the Most of Key Locations" and "How to Encourage Im-

*Menlo Park, California, September, 1961.

provement of Private Property," which lead to the "Conclusion" by Walter L. Doty, an editor of *Sunset* magazine.

People write in to the Council: "Our town is growing so fast it seems to be losing its character. What can be done?" "What can be done about eyesores?" and other such questions.

An "eyesore" is defined as "blatant inappropriateness that shocks the senses." A junk-yard may give such a shock, as will some types of billboards crowded in urban settings or betraying nature's own appearance. Disorder and confusion definitely create eyesores. "Now is the time to plan with vision: to zone carefully, to promote needed changes even if they cause some immediate disruptions."

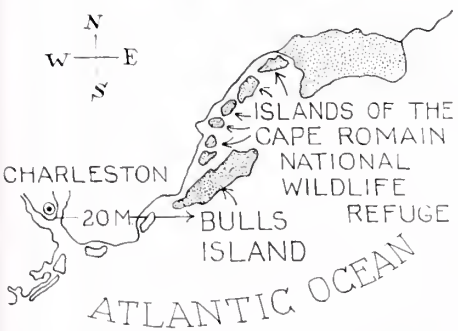
The California Roadside Council is a non-profit organization devoted to the conservation and development of beauty throughout the state. Primarily concerned with roadside appearance, it also advises on general problems of civic attractiveness.

The Santa Barbara Plans and Planting Committee of the Community Arts Association is the oldest group, founded in 1922. It has to its credit prevalence of harmonious architectural types and historic Spanish street names, public ownership of the entire waterfront, preservation of historic sites and buildings, complete landscaping of the freeway, pride in trees and gardens.

Mr. Doty concludes with the words: "There is no easy way .... If we accept ugliness as an inevitable part of progress, we will get ugliness. If we roll up our sleeves, work, organize, persuade, plan and pay, then we do have a chance to help tomorrow's California."

AN ISLAND SANCTUARY IN SOUTH CAROLINA

The plaque tells the story



Eva Melady

VISION and generosity prompted the two wise individuals named in the plaque (right) to have the wilderness surrounding their vacation home preserved in a wild state for others to enjoy.

Bulls Island lies in a subtropic zone off the coast of South Carolina. Since its discovery in 1670, its more than 5,000 acres have been through various ownerships. None of these has changed its pristine character. There are not many areas left to us with almost the same appearance today as of 300 years ago, except for the acceptable change of Nature's own routine. On this island of virgin forests and wide beaches there is hardly a trace of man, except for Dominick House, its out-buildings, the fire tower, a few miles of narrow wood road, and half a dozen small boats.

In 1936 the island was transferred by the owners to the permanent care of the U. S. Fish and Wildlife Service of the Department of the Interior. Its loblolly pines and magnolias, its live oaks, and its herons, ducks and egrets will thereby be preserved as long as Nature permits. The area has been made part of the Cape Romain National Wildlife Refuge.

Dominick House
Named in appreciation
of the cooperation of
Mr. & Mrs. Gayer C. Dominick
which made this
Bulls Island Sanctuary possible
for the benefit of the public

HOW TO EMBARK ON A CONSERVATION PROJECT

A method of procedure for the volunteer group

Alice Harvey Hubbard

MOST successful projects seem to follow the same general pattern, whether they are neighborhood efforts or nation-wide programs. These are the steps:

(1) *A public-spirited individual or group recognizes a need and determines to do something about it.* That need may be a recreational area, the elimination of water pollution, or the restoration of a sick watershed. It might be a beautification program, an anti-litter drive, a community forest, a soil conservation district, a town planning commission, or workshops to train conservation leaders. Whatever it is—the most successful projects are those which fill a basic need in the community or nation.

(2) *An analysis is made of the problem—with the advice of experts sought where necessary.* There are many instances where a civic-minded group has plunged headlong into a community project on a sink-or-swim basis and been highly successful, and there are others where a fine project never got off the ground because there was too much discussion and too little action. On the whole, the most successful groups have been those which made a careful analysis of the problem before they tackled it, drawing upon the advice and experience of experts. When this is done, the difficulties likely to arise are anticipated and plans can be made to meet them.

(3) *Teamwork is important.* Teamwork is the common denominator of every project, whether it involves forty families working for a rural recreational area, or conservation-minded groups all over the country joining in a fight to protect our national parks, or to keep the new highway system free of billboards. Small groups are limited in what they can accomplish alone, however public-spirited they may be. When the strength of all such groups in the community is combined, each taking a share of the responsibility, the possibilities for accomplishment are limitless. This is because, together, they represent a cross-section of community life and thinking.

(4) *A plan of action is worked out.* It is significant that the top winners in more than one contest for community achievement have been the groups responsible for the creation of centralized planning organizations. Even when only a small segment of the population is concerned about improvement of an area or conserving part of it, the plan of action may make the difference between a permanent achievement and a mediocre attempt.

(5) *A program of public education is undertaken.* There is little purpose in talking about the restoration of a sick watershed to people who do not know what a watershed is or how its condition affects them. A farmer is likely to be indifferent or even hostile toward a soil conservation district until he understands how it operates and what it will mean to him and his family. A sewage treatment plant, however badly needed, may well be voted down unless the people are made to see its importance to their welfare. All too often

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Adapted, by permission of the publisher and author, from Chapter XI of Mrs. Hubbard's book "This Land of Ours" (Macmillan, 60 Fifth Avenue, New York 11, N. Y. $4.95).

voters go to the polls and vote against an issue simply because they know nothing about it, and their general inclination is to vote against anything that will increase taxes. One of the essential ingredients in almost any successful project is a well organized program of community education.

(6) *The project is made the responsibility of the whole community.* In its own way, each community is a little America, representing what this nation stands for and its democratic processes. The most worth-while project, regardless of size, is one in which the community is led, or inspired, to help itself rather than have something done for it. Community participation should include young people and the older people because both have much to contribute and like to feel they "belong."

(7) *Finances are not always a major problem.* Where and how to raise the necessary money is a primary consideration in undertaking almost any project. When large sums are needed, as in the acquisition of the California redwood forests, big fund-raising drives must be planned and executed. In local projects more and more people today are cutting costs by contributing man-hours, applying the do-it-yourself idea to the community. Where money must be raised, they make it fun by having a dance, a bazaar, auction, or similar event. Indeed the successful group is usually one that has made the financing of its project a challenge rather than a problem, an opportunity for members to prove their ingenuity.

(8) *Successful groups work in harmony with public officials.* The majority of public officials are honest, hard-working individuals with the best interests of the community and nation at heart. Many groups have been frustrated in their efforts to carry out very worth-while projects simply because they overlooked the fact that these officials are often in the best position of anyone to help them.

(9) *Many groups use contests as a means of creating interest in their projects.* Competition apparently has a strong appeal to most people. A spirited contest, properly conducted, is useful in carrying out most projects, especially where the support of young people is sought. Contests have been used very effectively in the anti-litter drive and have contributed tellingly to its success. They have also proved valuable in promoting scientific soil practices.

(10) *Interest is sustained by publicity and progress reports.* Starting a project is one thing; following it through to successful completion is another. Publicity for publicity's sake is never desirable, but publicity to keep a long-range project going by means of achievement reports is sound business practice. In this connection the local newspaper editor is the best ally.

(11) *Provision is made for the maintenance and future security of the project.* It is sad that even the most public-spirited groups will sometimes spend a tremendous amount of time, money, and effort on a project, only to have it become forlorn and forgotten in later years because the members failed to provide for its maintenance, or its future security. This is often true of beautification projects and sanctuaries, or areas that have been set aside in their natural state. These precautions should be considered a part of the project, an essential to its successful completion.

(12) *The determining factor in the success of all community and conservation projects is enthusiasm.* One may ignore any or most of the rules for success in carrying out a project and still succeed, but enthusiasm is the lifeblood of all such projects. Without it the best of projects are doomed from the outset, for most of them entail a great deal of hard work, much of which is routine and unglamorous. A group may have every other ingredient for success, yet fail miserably for lack of enthusiasm. On the other hand, it may face seemingly insurmountable difficulties, with little but boundless enthusiasm—and do the job.

ISLAND PARADISE

UNIQUE, refreshing and encouraging!

For every acre of land sold for a home or business place by the Sea Pines Plantation Company, another acre is set aside as a permanently inviolate piece of woodland, swamp or marsh to be maintained as a wildlife sanctuary: a continuous block of original, untouched land is preserved and patrolled. What a great thing it would be for posterity if other companies followed suit!—ED.

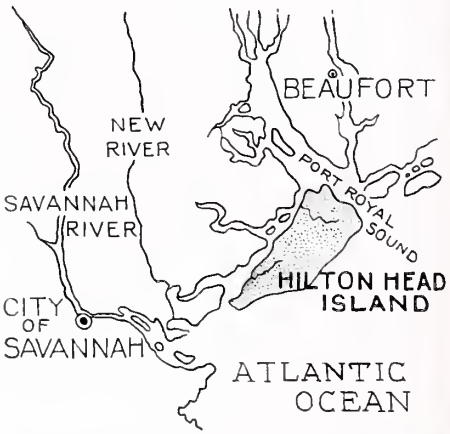
Alexander Sprunt, Jr.

DESTROY habitat, and wildlife vanishes, whether in tremendous tracts or in smaller areas of woodland, swamp, marsh or prairie. Among the "offenders" are the real estate companies who are more interested in selling lots, bulldozing trees and draining ponds than they are in the natural beauty of the land.

Informed conservation groups have not done what they might to advise them. Who knows but that some of them would listen with interest to the suggestion that at least some part of their areas might well be preserved intact? This article deals with a real estate development firm which, entirely of its own accord, does understand and is doing something about it.

The stated policy of this company is that "The Sea Pines resident-management-ownership group is devoted to the goal of preventing the great natural beauty of the Sea Pines area from being spoiled by the uncontrolled opening of the land."

The place, Hilton Head Island, is on the coast of South Carolina, 110 miles south of Charleston and 30 miles north of Savannah, Georgia. It is the largest of the so-called "barrier islands" of the southern Atlantic coast and embraces some 30,000 acres with a magnificent stand of magnolia, live oak, pine and cabbage palm (palmetto). Thirteen miles of superb sea beach front the ocean. The early inhabitants were, of course, Indians. Radioactive carbon tests



Eva Melady

HILTON HEAD, largest southern barrier island, lies 110 miles south of Charleston, S. C.

on their remains indicate that some were there 4,000 years ago.

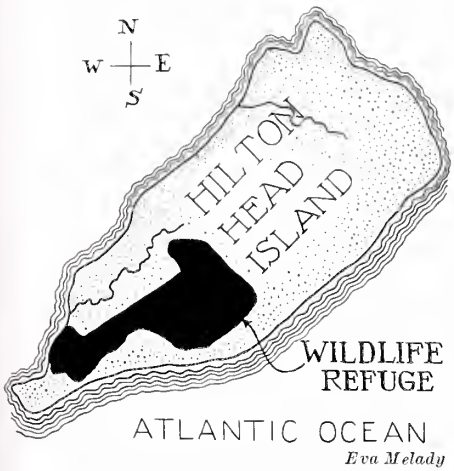
The Spaniards came to it soon after Columbus. The French founded a colony across Port Royal Sound in 1562, under Jean Ribault. The first Englishmen to come to Hilton Head arrived in the ship *Adventure*, commanded by Captain William Hilton, and anchored in Port Royal Sound in 1663. William Hilton made the first reference to birds ever to be recorded from what was to become the Province of Carolina. This is what he said:

> The Country abounds with Grapes, large Figs, and Peaches; the woods with Deer,

> Conies, Turkeys, Quails, Curlues, Plovers, Teile, Herons; and as the Indians say, in Winter, with Swans, Geese, Cranes, Duck and Mallard, and innumerable of other water-Fowls, whose names we know not, which lie in the Rivers, Marshes, and on the Sands.

The plantation era followed the founding of Charles Town in 1670. The planting and cultivation of indigo, then sea-island cotton (long staple) brought wealth to the planters.

In 1950 the present owners of the island secured it and two companies are now developing it, the Hilton Head Company and the Sea Pines Plantation Company. It is



Eva Melady

THE ISLAND'S SANCTUARY contains two square miles of virgin forest, pond and marsh land.

with the latter firm that this article is concerned. All of the officers live on the island and they are keen, energetic and enthusiastic believers in what they are doing: making real estate development and wildlife conservation work together. The island is now linked to the mainland by a splendid highway bridge completed in 1956. The beautiful motor lodge, the William Hilton Inn, which fronts on the ocean beach, is surrounded by a forest of oaks, pines, and palms.

Some two or three hundred residences have been built on the Sea Pines area. Many of the streets bear bird names such as Green Heron Road and Gannet Street.

The sanctuary area, lying in the center of the 5,200-acre property and comprising forest, pond and marsh habitat of over two square miles, is virgin territory. Here, in the spring of 1960, a thriving heron rookery of several species had a successful nesting season. This colony should result in an asset of growing interest. Plans are on foot for cutting a trail through the woodlands from the highway, and constructing an elevated platform at one end of the marsh-swamp area occupied by the birds. Bird-watchers will be able to see all the activities of the rookery with ease at a safe distance.

Hilton Head will doubtless become increasingly popular as a mecca for visiting bird groups, large and small. The combination of land, sea and marsh species makes it easy to run up a large list; a hundred different kinds in a day is possible.

In late September of 1960, an Audubon Society group was formed at an enthusiastic organization meeting at the William Hilton Inn. One of the first projects to be undertaken will be the institution of the country-wide Christmas Bird Count—the first of its kind on Hilton Head Island. The formation of the Audubon group was at the instigation and with the complete cooperation of the Sea Pines authorities as well as the Hilton Head Company and the Island Chamber of Commerce. The representatives of all these groups heartily subscribe to Julian Huxley's statement:

> "One function of the earth whose importance we have only just begun to recognize is that of wilderness, the function of allowing men and women to get away from the complications of industrial civilization and make contact with fine scenery and unspoilt nature. Of course, it is not everyone who likes wilderness; perhaps luckily a considerable number of people enjoy crowds and prefer their vacations to be organized. But wilderness-lovers constitute a sizable minority and also include a sizable proportion of interesting characters and original thinkers. Wilderness is, in the long run, one of the major functions humanity demands from the surface of the earth."

WETLANDS PRESERVATION

An example of what is needed and what can be done around the country

John E. Harney

Condensed from *The New York State Conservationist,* February-March, 1961.

OFTEN it is said: "If only we had realized what was happening, maybe we could have done something about it." Belatedly, we find we have failed to protect one of our most valuable resources—the wetlands of our nation. Fortunately, we can still do something to preserve a *part* of what is left.

Long Island, some 115 miles in length and 12 to 23 miles wide, is blessed with thousands of acres of tidal marsh land, and lesser quantities of fresh-water marsh along its streams. Thousands of acres already have been destroyed or so altered that their value for fish and wildlife has been greatly decreased. There remain, however, extensive wetlands, their associated mudflats and shallow bay waters. Preservation of this valuable resource, important as a source of food, for recreation, for scientific study, as a vital segment of the local and national economy, becomes increasingly important with each passing day. Once destroyed, it can never be replaced.

The delicate balance of salinity, temperature and currents provides the right conditions for spawning for the bluefish, common eel, flounder, fluke, menhaden, weakfish, hard and soft clams, oysters, scallops, shrimp and bait fishes. In money value, the annual harvest of shellfish on Long Island averages about $5,500,000, and the finfish harvest averages between $3,350,000 and $3,500,000 a year.

Wetlands and their associated mudflats and shallow bay waters are important too, for their vast waterfowl and shorebird populations. Nearly 180,000 wintering waterfowl have been counted in aerial surveys of Long Island in a single counting! They provide recreation for waterfowl gunners, bird-watchers and nature students, and they sustain numerous business operations.

Wetlands, in their natural state, provide a buffer for shoreline properties, dissipating the battering force of ocean-born storms and allowing storm tides to rise with minimum damage. They provide outdoor classrooms for high school and university students in the biological sciences.

Nearly three-fourths of our people live along the coastlines of our nation. Urban development, with industrial development,

WETLANDS. Tidal marshes, like these along the coast of Maryland, have economic and biologic values which argue strongly for their being kept as they are.

U. S. Fish and Wildlife Service

Resources of Tidal Marshes

CURRENT research has revealed that the marine resources derived from the coastal waters are dependent on and intricately associated with those marshes whose estuaries are the home of the oyster and blue crab and the nursery area for many other species. In addition, they provide essential nutrients (microscopic floating plants, mud algae, bacteria and organic detritus) which are carried into the surrounding waters each time the tide flushes over them. It has been calculated that over 500 pounds of sugar are provided on each acre of tidal marsh per year. Even the horse mussels so abundant on the marshes are now found to be playing a vital role in the phosphorus cycle.* While they are filtering water to obtain food, much of the organic material filtered out is sedimented in the form of pseudofeces. It is therefore retained in the estuarine system, where it becomes available to other organisms in the food chain.** By destroying our tidal marshes we are literally destroying a very important food industry and denying ourselves a vital source of protein.—WILLIAM A. NIERING.

*Plants have the power to convert inorganic phosphorus into organic phosphorus. The decay of marsh plants liberates the phosphorus for use by other organisms that are in the adjacent waters offshore and that are part of the complex food chain of living creatures. Since phosphorus is often in short supply, the plants in tidal marshes perform an important service for other aquatic life.

**See "The Role of Tidal Marshes in Estuarine Production" by E. P. Odum, *The New York Conservationist*, June-July, 1961.

recreation, transportation, communication and commerce, have destroyed or seriously altered the natural habitat that produces the fish, shellfish and waterfowl which people seek. We need to plan to insure preservation of our shorelines.

Few people realize how valuable tidal marshes are to our economy. Such wetlands are being destroyed to control mosquitoes, to reclaim land, to provide sites for housing and industry, to enlarge recreational facilities, to provide navigation improvements, transportation and communication, to remove sand and gravel, to provide fill for erosion control and hurricane protection for the beaches. We dump pollutants into the waters, hasten sedimentation, restrict or alter currents and add residual insecticides. The amount of food and the numbers of fish and wildlife decrease. We are the losers.

In 1955 a nation-wide survey showed that there were 37,450 acres of wetlands on and near Long Island. By the spring of 1959, 4,692 acres had been lost.

Through international agreements with Canada and Mexico we are committed to perpetuation of migratory bird resources. There should be not less than 12,000,000 acres of land in public ownership to meet requirements of migratory waterfowl.

Early in 1957 officials of the New York State Conservation Department and the U. S. Fish and Wildlife Service formed the Cooperative State-Federal Planning Committee for the Preservation of Long Island Wetlands "to assure the perpetuation of the remaining off-shore coastal marshes of the south shore of Long Island." Then, in 1959, the Long Island Wetlands Bill was passed by the State.

The first practical application of the Wetlands law was the cooperative agreement between the Town of Oyster Bay and the Conservation Department to develop the 500-acre wetland tract known as the Tobay Pond Bird Sanctuary.

Adoption of a well-integrated plan for use of tidal wetlands would set a precedent unknown on such a large scale. Federal wildlife agencies are in a position to provide specific management plans. The public can help. Let us for once avoid the need to say: "If we had realized what was happening, we could have done something about it."

NATURE PROGRAM FOR ALL AGES

Audubon centers carry education beyond the classroom

Charles Holtzer

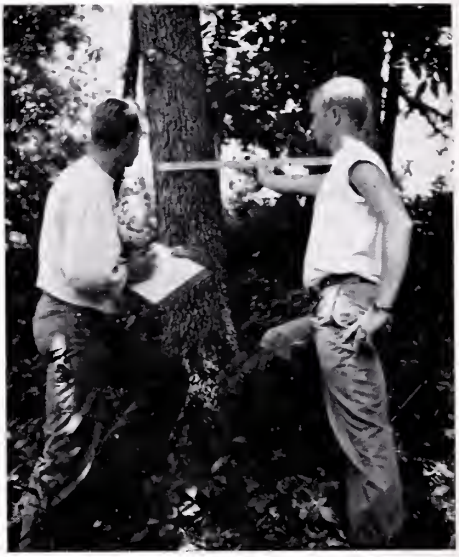
THE study of natural resources is coming to be recognized as a subject to be taught in our nation's schools today. Resources are basic to our country's economic health and the individual well-being of its citizens. For this reason it has every right to be added as a fourth "R."

We attempt through our education system to make good citizens out of our children. To educate them properly for their adult roles as citizens we should teach them their responsibility toward the protection and intelligent use of our natural resources. This should be the major goal of an active nature and conservation education program.

An outdoor interpretive program in natural history and conservation opens the gateway to a greater understanding and an appreciation of natural phenomena through utilization of the outdoor environment—the soil, water, minerals, animal and plant life in their natural habitat. Students learn by direct experiences through touch, sight, taste, smell and hearing. It is no more possible to teach many aspects of natural history through reading and studying pictures than to teach mathematics by employing the same methods. It is inconceivable to teach basic mathematics without certain working tools such as a pencil and slide rule. It is equally unrealistic to expect students to gain an intelligent understanding of their natural environment without the tools found in nature. "Learning by doing" is as important in teaching natural history as it is in many other subjects.

Many newly constructed schools have had—and lost—a priceless facility for teaching natural history and conservation. Since many elementary and high schools are not oriented toward utilizing the natural environment for its educational value, the land around a school is usually cleared of trees, running brooks are filled in, and the natural area gives way to cement playgrounds and manicured grass. Communities have spent money to destroy these valuable areas. Some schools, on the other hand, were fortunate in having local people who would not permit this to happen. As a result, a few have left intact much of their undeveloped land for educational purposes. Alert teachers in these schools have found ways of incorporating their natural areas into other academic subjects besides science. They have discovered that an interpretive program can greatly complement and enrich the entire school curriculum. As an example, the topography and natural resources of any country greatly influence its course of history.

These natural areas, which contain the flora and fauna indigenous to the local



Wisconsin Conservation Department

TREE RECORDS. Through nature centers, students are encouraged and enabled to carry on useful studies in the natural sciences.

scene, are, in essence, outdoor laboratories where students obtain direct contact with their natural world. It is here that explorations and studies can be engaged in, from kindergarten through high school, to cover such subjects as ecology, botany, ornithology, entomology, herpetology, geology, meteorology, aquatic biology, etc.

The National Audubon Society, realizing the need, has established a new department called the Nature Centers Division, which will encourage and assist communities in the establishment of nature and conservation centers. These centers, which contain sizable acreages of natural areas and their own educational buildings, operate the year round with full time naturalist-directors and other staff members. Usually they are supported in part by the city government and by private contributions and memberships. They cater to adult interests, too, have programs for daily class visits to the centers, and also offer workshops for teachers in natural history and conservation. If a school is fortunate enough to have its own natural area, the center staff will usually cooperate in helping the school make the best use of its own land. Because the center is open after school hours and on weekends, youngsters who wish to carry on their interest in nature study and related fields can come to the nature center for participation in field trips, for special workshops and for individual projects.

Through such outdoor and related activities the student begins to recognize and understand the complexities and interrelationships of all the living and inanimate facets of our natural environment. He can then begin to realize the fact that he is a product of the natural world and that he is still dependent upon it for his very existence.

Wisconsin Conservation Department

BUDDING BOTANIST. At a summer conservation camp in Wisconsin, a student works with pressed plant specimens.

JUNIOR CONSERVATIONISTS

Selected essays from the Setauket, Long Island, schools on "What I Have Done to Aid Conservation in My Community"

William Bentley
(Junior High School)

I have had many opportunities to aid conservation. I am very fortunate because my father is a professional in this field. Besides learning a great deal about the subject I have had many chances to help preserve our natural resources.

Ever since I was a very little boy I have accompanied my father on his job. I have helped to stock fish and release quail and pheasants. Our whole family has worked on stream improvement projects.

Last summer my brother and I got several hundred multiflora rose and autumn olive plants with the help of my father. We planted them in a double row near our house to provide food for the pheasants that abound in the field. They have grown fairly well and we hope it will begin serving its purpose this winter.

In the severe cold of last winter our family often fed corn to the waterfowl in Setauket Harbor. We also started a feeding station for the songbirds and the squirrels in our yard.

This year I got thirty pine trees of different types from the state and built a small nursery. I enlarged it by adding several seedling Japanese maples. Although not all of the maple trees survived the hurricane the pines are growing well.

When I first moved to Long Island I noticed the lack of snakes living here. I guessed that this was because they were unable to find adequate homes in this sandy soil. My brother and I moved several large pieces of plywood into the field and we have noticed that there are now many snakes living under them.

I realize that the conservation of our natural resources is very important and essential to the future of the country. Therefore I have and will continue to try to work in every way I can for conservation.

Mary Ann Peters
(Fifth Grade)

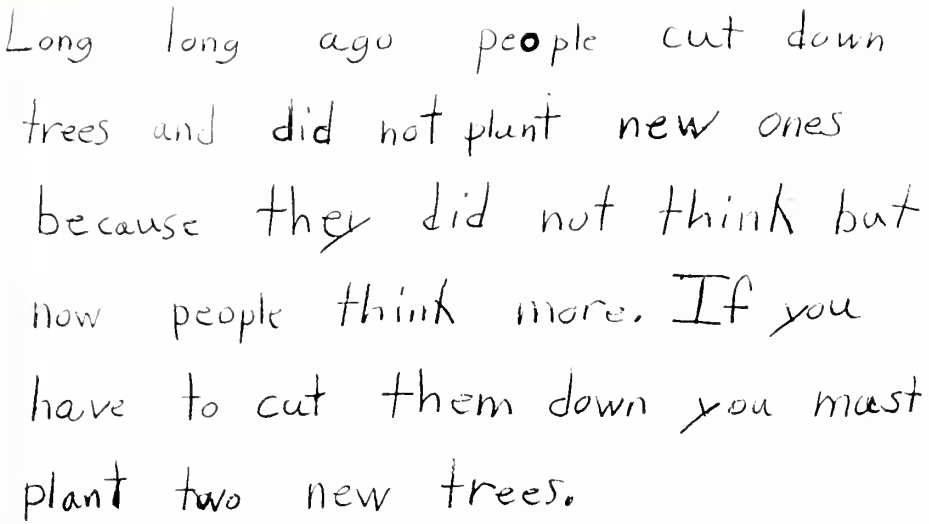
AFTER reflecting on my actions of the past few years towards local conservation I find that they were and still are passive and not positive. In order to rate myself more accurately I think it would be advisable to review the opportunities for helping conservation in the Three Village area.

To begin with there are two main types of conservation in this area, conservation of natural resources and conservation of wildlife. We don't have to worry about coal mines or forests in this area but we do have to care for clean bays and beaches. Someone who believes in conservation doesn't litter landscapes. When clean they contribute to our enjoyment. Littering them takes away their natural look and makes them look ugly.

Conservation of wildlife includes the wise use of both plants and animals. Clams are being dug and not used. Some are taken too small. Rabbits are being shot with bee-bee guns by boys who want to use them as targets. Fish that fishermen catch and don't want to eat are taken home and then thrown away. All this is waste and will eventually deprive us of these sources of enjoyment and food. Again, someone who believes in conservation should try not to do this himself and advise others not to do it either. Around here there are not many opportunities for big conservation projects. But we can help by doing little things to preserve the natural beauty and the many natural enjoyments in this area.

School Natural Areas

In a survey of schools the Long Island chapter of the Nature Conservancy learned that in Nassau County, of 145 schools reporting, 48 have natural areas. In Suffolk County, of 123 reporting, 53 have natural areas.


Long long ago people cut down
trees and did not plant new ones
because they did not think but
now people think more. If you
have to cut them down you must
plant two new trees.

CONSERVATION ESSAY by Terri Smith, a second-grade pupil in Setauket, New York.

THE CHILDREN HOLD THE KEY

THE way to build up a conservation force to guard our country's resources and beauty is to teach the children from babyhood. It is human nature to respond to live animals, to trees and water. It could be a simple matter to bring to every child the care of Nature and a knowledge of her needs. Much is, in truth, now being done on these lines, but probably only a small percentage of the total number of children is being reached. Every school should be equipped to give simple, direct information about clean water, the relationship of water and forests, the value of wildlife and a bit about ecology as part of the educational background for every child.—ED.

SUMMER IN A NATIONAL PARK

HIGH-SCHOOL and college students and college graduates are given an opportunity through the National Park Service to combine a volunteer summer job with training in conservation. This youth program is supported by private funds and managed in cooperation with the National Park Service of the Department of the Interior. It is designed, according to a leaflet issued by the Service, to provide assistance in maintaining the natural beauty of the parks and in serving park visitors while at the same time offering valuable opportunities to each qualified student volunteer. These opportunities include conservation education, in part through field experience, for which school credit may sometimes be obtained; learning the principles and problems of the Government's park program at first hand; gaining experience and job reference for future employment in the field, and, through the summer's work, contributing toward the country's conservation of natural resources, and thus to the national welfare.

PEOPLE AND THE ARCTIC WILDERNESS

Murie

BROOKS RANGE. The northernmost mountain mass on the American continent, stretching across the top of Alaska with some peaks 10,000 feet high, forms the major part of the new Arctic Wildlife Range.

Margaret Murie

IN the new State of Alaska lie the last large untouched expanses of wild country left in the continental United States. But more than ten years ago some alert and forward-looking Alaskans began to worry a bit about the future of these wild regions. The establishment of all sorts of military installations in the Far North set them thinking, and they began to wonder what the earth-moving and road-building machinery in the new style could do to even the most remote wild place.

In 1952 and 1953 George L. Collins, Chief of the Alaska Recreation Survey of the National Park Service, and Lowell Sumner, National Park Service biologist, traveled extensively in the northwestern section of the Brooks Range, the great mountain mass which extends, with all sorts of ramifications, roughly across the top of Alaska. They recommended that a large area in that region be saved for future sportsmen and other outdoor enthusiasts.

At about the same time, the New York Zoological Society and The Conservation Foundation sent Dr. A. Starker Leopold and Dr. F. Fraser Darling to Alaska to make observations on the status of wildlife in the whole territory; and in 1956 the two

organizations sponsored another expedition to the Brooks Range under the leadership of Dr. Olaus J. Murie, Director of The Wilderness Society.

After this expedition of 1956, several Alaskan organizations, including the Alaska Sportsmen's Council, the Tanana Valley Sportsmen's Association, the Fairbanks Garden Clubs, the Izaak Walton League of Anchorage, sent to the Department of the Interior specific recommendations for the preservation of a wildlife range. Later on, while legislation to create a wildlife range was being considered, Congressional hearings were held in all the principal cities of Alaska. The support for the legislation shown by Alaskans was surprising to some, and significant of the interest of Alaskans in their own land. It was very evident that opposition to the creation of such a wildlife range came from a few interests and was tangled in the game of politics.

While this and other discussions about areas in Alaska were going on, a small group of Alaskans organized The Alaska Conservation Society. This new organization rapidly drew to itself members from all parts of Alaska, as well as associate, non-voting, members from other states, and threw its support to the Arctic Wildlife Range. Finally, when Congress had not yet acted on this matter by December 1960, Secretary of the Interior Fred A. Seaton acted to establish the Arctic Wildlife Range, by executive order, the area to be under the administration of the Fish and Wildlife Service. The regulations governing the area were to be essentially the same as had been recommended to Mr. Seaton by the Tanana Valley Sportsmen's Association and the other Alaska groups.

Across the top of Alaska, back from the flat Arctic coastline some hundred miles, lifts the Brooks Range—a composite of many mountain groupings, but forming a continuous great mountain world one hundred miles deep and up to ten thousand feet high—massive rampart to all of interior Alaska. The Arctic Wildlife Range lies north of 68 degrees north latitude, generally bounded by the Arctic Ocean, the Canning River on the west, the Canadian boundary on the east. It is roughly 115 miles east to west and 100 miles north to south. Great caribou herds, mountain sheep, grizzly bears, foxes, lynx, wolf, and many more Arctic species of animals will be at home in this range. The area is especially dedicated to the preservation of the wildlife and the flora in its natural state, though hunting and fishing and other forms of recreation are allowed. There are also plans for the reintroduction of the musk-ox in some parts of the area.

A most important fact to remember about this region is that it contains a remarkable diversity within its boundaries. It extends from the sub-arctic on the south side of the Brooks Range, to truly arctic on the north; it contains the greatest variety of life in the smallest area. It is a near-perfect unit representation of the living Arctic.

The point to be emphasized here is that had it not been for the alert interest and the devotion and the persistence and faith of a most various, though comparatively small, number of *people*, the protection of this great Arctic world would never have been realized. A few Alaskan citizens, a few scientists, a few conservationists, a few organizations from east to west, from the Sierra Club on the West Coast to the New York Zoological Society and The Wilderness Society on the East Coast, plus a sympathetic and courageous government official and his staff—this is what it took. I have not gone into the details of the obstacles which were raised, the objections to be overcome, but the way was long and demanded constant vigilance and work. The significance to be drawn from the story is that "all things are possible" if *people*, even a few people, are fired with belief in a cause, and are determined to recognize no obstacle as insurmountable. And for the devotion of such groups the future will be grateful.

ANTARCTIC CONSERVATION

Sanctuary for native animals urgently needed in newly opened region

Robert Cushman Murphy

William J. L. Sladen

PENGUINS—an Adélie feeding young

ANTARCTICA, the most isolated terrain in the world, is now the only one in which man has not yet existed long enough to have had an overwhelming effect upon the native ecosystem. In almost every other land area he has transformed primordial conditions to such an extent that we have only an imperfect idea of what they once were. In Antarctica alone we can still observe a primitive climax.

The first southern ice-capped land known was South Georgia, discovered by Captain James Cook in January, 1775. His description of fur seals started British and Yankee sealers on forays. Within a few years after the American Revolution they had killed more than a million fur seals on South Georgia alone. There is no record of the unimaginable total slaughter on other islands around the world.

The wiping out of seals was not the only disaster. Rats gained a foothold as far south as their winter temperature threshold would permit, with devastating harm to native wildlife.

Fur-sealing and rats were the first destructive process. There followed a wanton exploitation of penguins and elephant seals for oil. The latest stage in the historic sequence is whaling, in spite of international efforts toward control.

But on the Antarctic Continent, the biosphere can still be kept intact, provided that the ideal and the means of its realization are held by all cooperating nations in this only section of the world not yet occupied and extensively changed. Civilized man can be the worst enemy of every form of life, the sole predator who takes his prey from motives other than that of personal survival.

The Antarctic has produced a spectacular assemblage of life above sea-level in numbers of individuals, though not, as in the less rigorous Arctic, in range of species. The penguins, the flying sea-birds, the seals of the shores and fast ice; the extraordinary invertebrates of pools that are frozen except for a few days in each year; the lichens, mosses and other cryptogamic plants—are there to be investigated through many scientific disciplines. We need these forms of life for ecological, behavioristic, sociological, physiological, medical, and many other reasons. We require them also for esthetic and humane ends.

Let us keep the Antarctic as we found it. Nobody any longer doubts the importance of national parks. The Antarctic might properly be regarded as an international

park or sanctuary—an idea which harmonizes with agreements among the nations which began joint research there during the International Geophysical Year.

This means that the pumping of ship's bilges, the use of explosives, and the harmful disposal of human waste are not to be tolerated. It means that colonies of penguins and other sea-birds are under no circumstances to be regarded as centers of amusement. An Antarctic Symposium at Buenos Aires in 1959 stressed the fact that each season ships bring companies who do not always understand natural life and its conservation, and who, if not supervised, will continue to cause serious damage.

Dogs represent a possible danger worthy of international consideration. Native Antarctic animals have never known terrestrial enemies so are not wary. Dogs and wolves are of the same genus. Dogs, let to run free, or worse, becoming feral, have butchered the penguins. It is horrifying to picture wild dogs surviving and multiplying on a winter diet of emperor penguins and a summer diet of Adélies, as long as the birds last.

An Antarctic International Park is clearly indicated, and on the way to wide discussion with fair chance of success.

Condensed from *Science*, January 19, 1962.

A WORLD-WIDE BASIS FOR CONSERVATION

TWO recent events in the United States have focused attention on the international character of conservation. One was the launching of the American branch of the World Wildlife Fund at the Waldorf-Astoria Hotel in New York June 7, 1962. The other was the first World Conference on National Parks, which brought representatives of 71 nations together in Seattle in July. To work for preservation of land in its natural state was the avowed goal of every delegate. The trend in today's conservation work, it was made evident at this conference, is increasingly international.

At the New York dinner, which was presided over by Dr. Ira N. Gabrielson, guests of honor were H. R. H. Prince Philip, Duke of Edinburgh, and H. R. H. Prince Bernhard of The Netherlands, who is President of the World Wildlife Fund. Britain's Prince Philip addressed the assemblage, saying in part:

"The Fund which is being launched tonight may well be responsible for changing the course of human history. The World Wildlife Fund has been formed in order to try and conserve the world's rapidly diminishing wildlife of all kinds.

"The passenger pigeon which used to darken the skies of North Ameriea was exterminated in one generation. Today, there are 250 species of animals and birds in danger of extermination. The national symbol of the world's greatest nation, the bald eagle, is on tbe list.

"The golden eagle of North America is being chased and killed by people in light airplanes who think it smart to have their feathers and claws. The Arabian oryx is being killed by some Arabs who think they will inherit its courage and virility.

"Industry and science are polluting the air, the soil and the water, unintentionally, maybe, yet effectively killing off vast numbers of animals and fish. Killers for profit destroy rhinos for their horns and elephants for their ivory tusks. In Africa, 600 elepbants are killed a year because game laws cannot be enforced.

"The moral reasons for conservation are obvious. We collect vast sums of money to preserve man-made treasures. We now must collect to preserve the living God-made treasures of the world—a new Noab's Ark to be built by men and women and children throughout the world. It involves educating people, influencing governments, enforeing laws, initiating research, conducting surveys, buying land, and rather like Noah, propagating threatened animal species."

THE PESTICIDE PROBLEM

"SEE that the pesticide problem is handled with judgment!" This was the concluding admonition of Dr. Clarence C. Cottam in an address given to representatives of 130 conservation organizations in Minnesota in 1960. "Chemical warfare presents heavy problems," he commented. "Wisely used, pesticides have improved agriculture and health. Improperly used, they have done serious damage to wildlife and possibly to health. Millions of pounds of chemicals are in use in brand-name formulas. Adequate research for thorough guidance of such use is essential."

Dr. Cottam, who is Director of the Welder Wildlife Foundation in Sinton, Texas, is not alone in his plea that chemicals used against pests be applied with caution and discretion. Demands from conservation leaders and laymen across the country have been heard from platforms and seen in print. In most instances, the natural enemies of pests have not been given a chance to bring about a healthy balance between the attacker and the attacked.*

New Pest Control Review Board

In the fall of 1961 the Federal Government, responding to President Kennedy's

*See "Biological Control of Plant Pests," edited by Cynthia Westcott. The Brooklyn Botanic Garden's Handbook No. 34.

Hugh M. Halliday from NAS

NATURAL PEST CONTROL. A single brown thrasher is capable of consuming more than 6,000 insects in a day. This is in addition to the thousands more brought to the nest.

Special Message on Natural Resources, established a Federal Pest Control Review Board, in order to minimize harmful effects of pesticides. This board will co-ordinate the work of the Departments of Agriculture, Defense, the Interior, and Health, Education and Welfare. It will be particularly concerned with pesticide uses that involve possible hazards to human health, livestock, crops, fish and wildlife.

Meanwhile, scientists are hopefully pursuing field and laboratory research on biological, or natural, control of insect pests, combined if necessary with chemicals selectively toxic for the species to be controlled. This is aimed at protecting the birds and snakes and small mammals that eat insects. If they do not eat enough, a poison that is toxic only to the insect causing the trouble can be administered, if present investigations are fruitful.

Responsible attitude needed*

Insects are man's greatest competitor for the food he eats. Our survival demands that we control them effectively.

However, this does not demand that we spray-kill everything that crawls, flies, bites or bores. In too many cases we have also killed birds, animals, fish and bees, and we have poisoned the streams from which we drink, and the fruit and vegetables we eat.

Pesticides, wisely applied, have done much to improve agriculture and give us better health, but their use involves a calculated risk and demands widespread education. Farmers have a definite responsibility for safe use of chemicals, and those who instruct them in the use of chemicals have even greater responsibility.

Unknown ten years ago, there are now on the market well over 12,500 brand name products and more than two hundred basic control compounds. These, while fulfilling their function on land, may enter our water supply by direct application to the water surface, by drifting onto the water surface from treated fields, or by seepage from the watershed. This offers death to fish, to birds, to aquatic animals, and, it may be, danger to man. As a speaker said at the National Conference on Water Pollution in Washington in December 1960: "We are running an unnecessary risk when we just blithely go ahead and use these things because we have not died yet." The report of this conference is available from the Superintendent of Documents, U. S. Government Printing Office, Washington, D. C., for $2.25.

We need pest control, but it is imperative that it be guided by responsible and objective leadership and that other interests be appropriately co-ordinated with the objectives of control.

As a start, public education and education on the county agricultural representative level should demonstrate to users of sprays and insecticides of all sorts that the material is extremely toxic to fish life and must be excluded from our waters. A strong declaration on the national level and by provincial governments would have a beneficial effect in the public interest.

There is proof aplenty of the need. Several years ago severe mortality occurred among coho fry, trout and steelhead yearlings when a western province forest was sprayed to control the blackheaded budworm. Ninety-one per cent of young salmon were killed in an eastern province when a forest was sprayed against spruce budworm, and aquatic insects wiped out at that time had not re-established themselves even sixteen months later.

*From the Monthly Letter of the Royal Bank of Canada, September 1961.

OIL IN THE SEA

An International Committee on Pollution of the Sea by Oil, founded in 1954, has recently met in London. Much progress has been made toward reception facilities on shore for oil wastes, and prohibited zones have been established over all the oceans where oil wastes may not be discharged into the water. To protect the lives of birds and fish, the goal is to have no oil wastes whatever poured into the sea.

THE JUDICIARY DECIDED

And New York's Forest Preserve was saved from encroachment

WHEN New York State's Forest Preserve was established in the Adirondacks in 1894, a stipulation was made that it should be kept "forever wild." Many times since then, attempts have been made to intrude on these primitive lands. As recently as 1961, the Association for the Protection of the Adirondacks saw fit to distribute an excerpt from the report of its president at the annual meeting of 1934. This concerned the court decision made in 1929, which protected the Forest Preserve from a bob-sleigh run. Portions of it are reprinted here.

The report

"One of the most important matters in connection with the Association's activities for the maintenance of the constitutional protection of the Forest Preserve originated in 1928, when the Association was approached by persons interested in winter sports in the Adirondacks and particularly in providing facilities for the winter Olympic Games of 1932 at Lake Placid. Among the facilities proposed was the construction of a bob-sleigh run, 1¾ miles long and 12 feet wide, and a return way of equal length, on State land. This would involve material destruction of trees, contrary to Section 7, Article VII, of the State Constitution. The Association expressed its opposition to the project.

"Action was brought by the Association and by John G. Agar, its President, in 1929 against Alexander MacDonald, Conservation Commissioner, and William G. Howard, Superintendent of the Division of Lands and Forests, on an agreed statement of facts. The case was presented to the Appellate Division, Third Department, in Albany, November 26, 1929.

"In the statement of facts it was shown that 2,600 trees and 4½ acres of land would have to be cleared for the run as planned on State land. It was also shown that possible sites on private lands could be found in the vicinity of Lake Placid.

"The Appellate Division unanimously upheld the contention of the Association. The opinion was written by Justice Hinman. He said in part:

> If clearings of timber from lands owned by the State in the Forest Preserve are sanctioned for such a purpose (the bob-sleigh run) they are equally sanctioned for the construction of public automobile race tracks, toboggan slides, golf courses, baseball diamonds, tennis courts and airplane landing fields, all of which are out of harmony with forest lands in their wild state. There will be no limits to such encroachments that will crowd through the door of such precedent if established. As we view it, the Legislature has no power to open that door. If the people desire to use their great park for such recreation a constitutional amendment is necessary.

"The case was taken to the Court of Appeals, which also unanimously upheld the position of this Association by affirming the decision of the Appellate Division on March 19, 1930. In the opinion of the highest court of the State, written by Judge Frederick C. Crane, it was stated:

> This plea in behalf of sport is a plea for an open door through which abuses as well as benefits may pass. The Constitution intends to take no more chances with abuses and therefore says the door must be kept shut. The timber . . . . cannot be cut and removed . . . . simply and solely for the reason that Section 7, Article VII, of the Constitution says it cannot be done.

"Thus prevented from building the bob-sleigh run on State land, its promoters proceeded under the other bill introduced by Assemblyman Porter, and it was constructed by the Conservation Commissioner on Van Hoevenburg Mountain, on private land on which an easement was granted. The bob-sleigh contests in the 1932 Olympic Winter Games were held there. The Conservation Department has since maintained the run."

CAREER IN CONSERVATION

Thousands of people are needed today to work for conservation, declares a leader who has touched every aspect of the field

Grace E. Barstow Murphy

DR. Ira Gabrielson, Director of the Wildlife Management Institute, last spring stated for me the major problems of conservation as he sees them today.

Harris & Ewing

IRA N. GABRIELSON, zealous conservationist.

1. Get the Wilderness Bill through the U. S. Congress. It will need a lot of help here in the East to overcome the cattle, timber and mining operators in the West.
2. Get better management of the domain. Udall, Secretary of the Interior, is trying to do it but will need lots of support.
3. Get the seashore areas that should be in public ownership. We have Cape Cod. Nationally, we still need Padre Island, Point Reyes, Oregon Dunes, Sleeping Bear, and Fire Island, as well as the Indiana Dunes along Lake Michigan. There are about eighty smaller areas that ought to be owned either by states or local governments to assure public use and protection from despoilment.
4. Stop pollution of our streams and lakes.

He went on: "Thousands of people are needed on this. This is how we win battles. Nearly every park and many of the great wildlife refuges exist because some one or a few individuals dedicated themselves to getting it done. The great leaders who really started this thing were Theodore Roosevelt, Gifford Pinchot, Gilbert Pearson and Carl Schurz."

We spoke of the highway engineers who so often plan to run their roads through parks, sanctuaries, and other valued places. "They don't care a hoot about anything," said Dr. Gabrielson with disappointment.

I asked him how he happened to make conservation work his lifetime career. He answered: "When I was in college, I read Hornaday's 'Our Vanishing Wildlife.' I got interested."

At about that time, the big fight started to abolish spring shooting of waterfowl. He "jumped in to help." He wrote letters and articles that got him into a "big fight" with the state game warden of Iowa.

By 1913, by an act of Congress, spring shooting was permanently stopped by the Migratory Bird Treaty.

"I've been working on this kind of thing ever since," he said to me. He worked for better management of public lands, to set up the first nine cooperative research units, for the preservation of the Malheur and Klamath Tule areas, now federal refuges, against the use of live decoys, for better wildlife management and always for building up public sentiment. His eyes fall on every corner of our land, and his encouragement of everyone else's projects is probably responsible for much of the conservation work in our country.

"I've been mixed up in every fight to preserve and get better management of our natural resources since I was young," he said.

SOURCES OF INFORMATION

ADVICE on various aspects of conservation programs and problems is available from national, state and local organizations. In a plea for funds for some of the most active of the national groups, Richard H. Pough, President of the Natural Area Council, has listed fourteen membership organizations. While all will welcome support they can be expected also to welcome inquiries through which they can help smaller groups to get started on worthy projects in conservation. All, Mr. Pough points out, are deeply concerned with one or more aspects of the preservation of open space around our growing cities.

American Planning & Civic Association, 901 Union Trust Building, Washington 5, D. C.
American Scenic & Historic Preservation Society, Federal Hall, Wall & Nassau Streets, New York 7, N. Y.

American Shore and Beach Preservation Association, 810 18th St. N.W., Washington 6, D. C.
Izaak Walton League of America, 1326 Waukegan Road, Glenview, Illinois
National Audubon Society, 1130 Fifth Avenue, New York 28, N. Y.
National Conference on State Parks, 901 Union Trust Building, Washington 5, D. C.
National Parks Association, 1300 New Hampshire Ave., N.W., Washington 5, D. C.
National Recreation Association, 8 West Eighth Street, New York 11, N. Y.
Natural Area Council, 33 Highbrook Avenue, Pelham, N. Y.
Natural Science for Youth Education, 114 East 30th St., New York 16, N. Y.
Nature Conservancy, 2039 K Street, N.W., Washington 6, D. C.
Sierra Club, 1050 Mills Tower, San Francisco 4, California
Wilderness Society, 2144 P Street, N.W., Washington 7, D. C.
Wildlife Preserves, Inc., 314 Engle Street, Englewood, New Jersey

Names and addresses of state and local as well as national organizations will be found in the Conservation Directory issued by the National Wildlife Federation, 1412 Sixteenth Street N.W., Washington 6, D. C. Copies are available from the Educational Servicing Division at $1 each.

CONSERVATION LIBRARY CENTER

THE most extensive source of conservation information in the future promises to be the Conservation Library Center of the Denver Public Library. A grant from the American Conservation Association started the new project on its way early in 1962. Private collections were immediately pledged and other materials, historical and current, are being assembled. The center will bring together, and offer for public use, significant records of the conservation movement.

Materials being selected for deposit there, it is planned, will fall within the framework of the following definition:

"Conservation is thought and action directed by man to protect, maintain and fortify the environmental complex that supports and enriches life as it now exists on the planet earth."

The center is seeking materials dealing with the protection, maintenance and enhancement of productivity in soils; the maintenance of greatest serviceability in waters; sound management in forests, cultivated fields, grasslands, wildlife, minerals and outdoor recreation facilities; and the best use of natural resources and elimination of waste in their utilization.

These may exist in such forms as books, booklets, bulletins, pamphlets, periodicals, motion pictures, and drawings or paintings which portray significant facts concerning our natural resource wealth, past and present.

Inquiries as to the suitability of available materials are welcomed by the committee in charge. John T. Eastlick, Librarian at the Denver Library, directs the work with Arthur Hawthorne Carhart, conservationist and author, as consultant.

SOME REFERENCE BOOKS ON CONSERVATION

A guide for the layman

Compiled by Richard L. Weaver

Allen, Shirley A., *Conserving natural resources*, McGraw-Hill, 1955.

Black, John D., *Biological conservation with particular emphasis on wildlife*, Blakiston, 1954.

Brown, Harrison, *The challenge of man's future*, Viking, 1954.

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Wengert, Norman, *Natural resources and the political struggle*, Doubleday, 1955.

Conservation Periodicals

Most of the organizations listed on page 64 have informative bulletins, and some have magazines to which one can subscribe. *Living Wilderness*, published by the Wilderness Society, the *Sierra Club Bulletin*, by the Sierra Club, and the *Audubon Magazine*, by the National Audubon Society, are good examples.

In nearly every state, at least one publication is issued concerning conservation or wildlife. A few are put out by non-official organizations. Most are issued by some State department, such as Fish and Game, or Forests and Parks, or Conservation. An outstanding example of the last is *The New York State Conservationist*, published in Albany.

Among other magazines with a strong leaning toward conservation is *Natural History*, published by the American Museum of Natural History, New York 24, N. Y. Conservation projects are sponsored by the National Council of State Garden Clubs, Inc., and by the Garden Club of America. Their publications are distributed mainly to their members.

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34. **Biological Control of Plant Pests** $1.00
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ERNESTA D. BALLARD (Mrs. Frederick L., Jr.), grower of unusual plants and proprietor of Valley Gardens, Chestnut Hill, near Philadelphia; field lecturer for the Pennsylvania Horticultural Society. Author of "Garden in Your House" (1958) and "The Art of Training Plants" (1962), published by Harper & Bros.

BERNICE BRILMAYER (Mrs. Robert C.), West Redding, Connecticut. New England editor for *Flower and Garden;* contributor to most of the horticultural magazines; author of "All About Begonias" (1960) and "All About Vines and Hanging Plants" (1962), published by Doubleday. Also edits the Bulletin of the Horticultural Society of New York.

ALBERT AND TRUDY BUELL, specialists in growing and hybridizing gloxinias, Eastford, Connecticut.

ELSIE FORD CATLIN (Mrs. C. Wilfred) received the Certificate of Merit from the Federated Garden Clubs of Connecticut; member of West Hartford Garden Club.

HELEN B. FARNHAM (Mrs. A. H.), a specialist in rare plants, Boynton Beach, Florida; writer and lecturer.

RUDY J. FAVRETTI, extension garden specialist, Plant Science Department, University of Connecticut, Storrs; author of "Growing for Showing" (1961), published by Doubleday.

OLIVE S. HULL (Mrs. William Henry, Jr.), Woodbridge, Connecticut. Trophy winner in amateur classes at New York's International Flower Show for many years.

JAY S. KOTHS, Assistant Professor of Horticulture, University of Connecticut, Storrs; extension specialist in gardening.

LOUIS J. KUESTER, New York. Amateur plant grower; past president of New York Branch, American Begonia Society.

HAROLD O. PERKINS, Guest Editor of this Handbook; Professor of Horticulture, *Emeritus*, University of Connecticut, Storrs. Landscape architect; horticulturist.

RUTH MARIE PETERS, New York. Indoor gardening editor of *Popular Gardening;* author of "Bulb Magic in Your Window" (1954), published by Barrows, and "Your Garden in Town" (1957), published by Henry Holt.

THOMAS POWELL, New York. Free-lance writer and assistant editor of Greater New York Orchid Society's monthly publication.

PEGGIE SCHULZ, Minneapolis. Garden Club editor, *Flower and Garden;* author of several books including "Growing Plants under Artificial Light" (1955), published by Barrows, and "How to Make Money from Your Home Greenhouse" (1959), published by Van Nostrand.

HENRY TEUSCHER, Curator *Emeritus*, Montreal Botanical Garden; author of "Window-box Gardening" (1956), published by Macmillan and co-author of "Soil and Its Fertility" (1960), Reinhold.

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NOTICE OF CHANGE OF ADDRESS AND ALL OTHER CORRESPONDENCE SHOULD BE ADDRESSED TO:
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Roche

This charmingly decorative specimen is a tropical shrub that will grow indoors throughout the year. It has been trained asymmetrically by selective pruning, and by wiring a few branches. Artistic placement in a suitable container is no less important than the form in which the plant is trained.

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Autumn 1962

In spite of the urban life that nearly 90 per cent of us lead, we all spring from generations back that once hunted game for food in the out-of-doors, or shepherded flocks, or later, tilled the soil. The once universal practice of growing plants for food has given way—for most of us—to growing plants for pleasure. Fortunately, indoors or out, everyone can be a gardener today and this Handbook is for the indoor gardener whose recreational urge is to have the company of 'living green.' Some say that there is a green-hunger in every living person, and that in temperate climates, at least, caring for house plants satisfies this urge. I am inclined to believe that this is so.

It is a challenge to grow a plant well, perhaps a species or variety that is new to us, or difficult of culture. Once successful, we move on to the next challenge, and so it goes. Many a home is overstocked with an accumulation of such challenges. Indeed, hardly a month goes by that the Botanic Garden is not offered someone's much-loved collection of this or that, perhaps an orange-tree grown from seed, or a rubber tree that in a decade or two has outgrown the home space available for it. A helpful rule is to "throw out the large, continue with the small."

There are two schools of house-plant enthusiasts—the collector-growers, and the growers-for-interior-decor. If you are the former, you may live in a miscellaneous indoor forest—but one that brings you joy. And if the latter, you use plants with restraint to achieve a decorative effect. Everyone to his taste!

Editor Perkins, his carefully selected authors, and our Editorial Committee all have lived with house plants problems; their accumulated experience is recorded in this Handbook for your guidance and pleasure.

Good growing!

Sincerely yours,

George S. Avery, Jr.

Director

A later thought: If you are all nerves, twitchy, and find yourself doing one thing and looking around for what comes next, then it is time to relax. Go in for house plants, and discover serenity.

An offer: We have a few hundred seeds of flowering dogwood *(Cornus florida)* that have been through the digestive tracts of birds. With simple additional treatment, they will germinate readily. Please write for a small packet of seeds—if you can use them.

BASIC PRINCIPLES OF GROWING HOUSE PLANTS

Rudy J. Favretti

BEFORE delving into the actual growing of house plants, the prospective grower should give considerable thought to the kinds he will select and their requirements in the home. Proper selection is of utmost importance not only from an aesthetic point of view but for success in growth and flowering.

There are five main factors to consider carefully. These are light, temperature, soil, water and humidity. We can manipulate the soil and water relationship of the plants with relative ease, but adjusting the light and temperature in the home to suit the plants usually means some discomfort, however slight, to the inhabitants. For this reason, it is usually wise to select plants that fit into your home environment rather than to change the environment to fit the plants.

Knowing the light and temperature requirements of the plants you wish to grow will prevent many future disappointments. Attempting to grow cyclamen in the present-day living room is futile because the temperature is too high. Cyclamens need a low (50-55° F.) night temperature. Camellias drop their buds when the temperature is too high, and so do gardenias. But gardenias also drop buds when the temperature is too low. Our grandmothers grew gorgeous, bloom-laden

This picture shows the water relationship between clay and plastic pots. Coleus plants in the clay pots were watered when the soil indicated the need. The coleus in the plastic pots received water at the same time, resulting in dwarf plants due to water-logged soil.

Scarchuck photos

geraniums in their cool kitchens, but in the homes of today which have constant, even heat, geraniums suffer and the lower leaves may drop.

Poinsettias will not flower when the length of day exceeds twelve hours. This means that when it gets dark outside in the fall, it must also be dark in the room where poinsettias are growing; the light from a television set or from a table lamp is enough to keep them from flowering. This is also true of kalanchoes, Christmas cacti, and chrysanthemums.

While the length of day (photoperiod or duration of light) affects flowering and growth, another factor, namely light intensity, does also. African violets will not flower when the light intensity falls below 500 foot candles, nor will they flower when it exceeds 1,300 foot candles. When we consider that the light intensity on a sunny summer day in New England is between 10,000 and 12,000 foot candles, it is apparent that African violets do not require a very high light intensity. Gloxinias are similar in this respect. While they will flower at high light intensities, the blossoms become few and small, and the rate of growth decreases when the light intensity exceeds 4,000 foot candles. Begonias, too, dislike high light intensities, but they thrive in stronger light than gloxinias and African violets. On the other hand, geraniums, cacti, gardenias, coleus, and amaryllis are members of a group which demands full sunlight.

The matter of light duration and intensity, temperature, and the aesthetic appearance and mature size of a particular plant are of great interest and must definitely be considered. In the article entitled "100 House Plant Portraits," much valuable information is presented to aid in the selection of plants for particular locations in the home.

Soil and Water

Once the selection of a particular plant has been appropriately made, it is a relatively easy job to keep the plant in good

This picture shows the reverse of photograph on page 4. The coleus in the plastic pots on the left were watered when the soil indicated the need, and the plants in the clay pots on the right were watered at the same time. The coleus on the left grew well but those on the right grew very slowly because of the lack of water.

condition. Understanding the importance of a good soil mixture, the elements it contains, how to replenish these elements, how to water the soil, and which container to use is important since most house plants die because they are growing in poor soil, are over- or under-fertilized, or are over- or under-watered.

While the soil in the pot serves the valuable purpose of supporting the plant, it must also be a storehouse of water, nutrients, and oxygen. This is why we make soil mixtures for house plants rather than use straight soil as it comes from the garden. Garden plants may be able to grow perfectly well in a particular soil, while the same soil placed into a pot will not grow a good house plant. This is because the roots of the garden plants have a larger area in which to grow while potted house plants are confined to a small amount of soil.

Soil in some areas is heavy, largely clay. In other localities it is light and sandy. Heavy soil compacts and does not provide good aeration. Sandy soil, on the other hand, is well aerated but the water goes right through it and it doesn't have much nutrient holding surface. Consequently, we make a soil mixture by using garden loam which has some clay to provide nutrient and moisture holding capacity and some sand particles to loosen it and give aeration. We add peat moss to make the soil spongy and retain water as well as to provide more nutrient holding surface. If the garden loam is more light than heavy, we add less sand to the mixture.

Usually, a mixture consisting of two to three parts of good garden loam, two parts peat moss, and one part sand is satisfactory. For cacti, less peat and more sand is desirable, and for ferns and other organic soil plants, more peat is recommended.

After the basic mixture is made, it should be tested and corrected according to the soil test recommendations. It may be that some lime and fertilizer are necessary. It is well to remember that gardenias, azaleas, and many ferns do not like a sweet soil; they prefer a more acid condition.

Selecting the Pot or Container

There is considerable controversy as to the best type of container for house plants. Many people swear by the standard clay pots while others prefer a plastic or ceramic pot. Actually, it really doesn't matter which type of container is used as long as the grower is willing to adapt his watering techniques accordingly.

It is wise to select a container that has drainage holes in the bottom to avoid the danger of excess water accumulation. When a container that does not have drainage holes is used, however, place pebbles in the bottom and use a good soil mixture.

Most of us are accustomed to clay pots which are porous and which permit the loss of excess water through the sides of the pot as well as through the drainage hole.

Plastic and ceramic pots are not porous and the only exit for water is the hole in the bottom. While plastic and ceramic pots may be more decorative than clay pots, watering must be done more carefully when using them. Because the walls lack porosity, plants in plastic or ceramic containers need not be watered as often (see illustrations).

House plants, regardless of the type, should be watered according to their needs rather than by a fixed daily schedule. When the soil in the pot at the depth of ½ inch feels dry, it is time to water; when it is moist, do not water. Whenever watering is necessary, it should be done so thoroughly that the water comes out of the drainage hole; then all of the soil in the pot is moistened. This favors uniform root distribution throughout. When only the upper inch or two of soil is moistened, this encourages roots to form only at the surface. When the soil dries out, the roots die, and the plant then expends its energy producing new roots instead of producing lush growth and flowers.

Pots should never be allowed to stand in water for more than ten minutes. If the saucer beneath the pot still has water in it by the end of that time, the water should be removed.

Warm water is far better for house plants than cold water for it moves into the plant more quickly. Ideally, it is best to use water that has reached room temperature.

Soil Fertility

Several years ago, the method considered best for feeding house plants was to fertilize them every three to four weeks, usually with a fertilizer which was medium in nitrogen and high in phosphorus and potash. Today we recommend fertilizing house plants with a weak fertilizer solution once a week and using a fertilizer medium in nitrogen and phosphorus and high in potash. Weekly feeding gives the plants a more constant and even supply of fertilizer in contrast to the stronger monthly application which may cause plants to grow in "fits and jerks."

Commercial house plant fertilizers are easy to use and can be mixed with water for application. A fertilizer having an analysis of 7-6-19 is ideal.

Because the soil in the pot breaks down after a period of time and also accumulates fertilizer salts to excess, it is a wise practice to re-pot most house plants yearly. Many gardeners re-pot in midsummer so that the plants can become adjusted and will be attractive by fall when their beauty is needed in the home.

Humidity

The average home is a desert when it comes to growing house plants. Although cacti and succulents, for example, thrive on these dry conditions, other plants, such as orchids and gardenias, many of the ferns, and tropical plants, suffer from the low humidity.

When plants are grown in masses on the window sill, they may be placed on a metal tray containing small pebbles which can be sprinkled with water. As the water evaporates, the humidity is raised. The same thing can be done in modern planter boxes. This may not be enough for orchids, however. They may have to be grown in a glass case which maintains a higher humidity. In the case of gardenias, spraying them with water once or twice a week will provide sufficient humidity.

Fancy-leaved geraniums (Pelargoniums) require a sunny window and cool nights. *Cox*

GROWING HOUSE PLANTS IN A CITY APARTMENT

How one grower has succeeded in raising fine plants in a hostile environment

Louis J. Kuester

PERHAPS no environment surrounding house plants offers more challenge to the skill of the indoor gardener than that of the average city apartment home.

The dust and polluted air, high temperature and low humidity of city apartments, and the limited facilities for resting plants are handicaps not usually encountered in other locations.

Despite the difficulties, many city people grow at least a few house plants. For those who are interested in going beyond growing just the "toughies," I hope I can offer some help, by outlining some of my methods in growing many kinds, from snakeplants to orchids, in a New York City apartment.

On Window Sills

Most of my plants are grown the year 'round on window sills. Windows face southeast and southwest. Installed on the window sills are galvanized metal trays. They are 2½ inches high, and as wide and as long as the sills, and are filled with water. Wooden racks, built of spaced strips (see photo) are fitted over the tops of the trays. The potted plants rest on these racks and do not stand in water.

One window (7 feet long) has a long low radiator in front of it. A conventional radiator enclosure is used with the top lined on the underside with a sheet of heavy asbestos. There is also a tray, 4 feet long, resting on top of the radiator. The total water content of these trays is about 15 gallons.

Several tests with a humidity gauge indicated that the relative humidity in the immediate vicinity of the window plants was about 15 per cent higher than the remoter areas of my apartment. Since temperature is usually lower near the windows, some allowance must be made for the above-mentioned figure. My best estimate is that the presence of water near the plants increases the relative humidity about 10 per cent. This is not much in a low humidity environment, but it helps. If my humidity gauge is not wrong, it is my opinion that the use of small dishes containing damp moss or water is of little value.

Enclosed Case

Some plants are housed in a large 3x3x4-foot wood case (see photo) with a glass top and three glass sides. This case is used for rooting cuttings, transplants, and forestablished plants needing high humidity.

According to the humidity gauge, the glass case provides a relative humidity ranging from 60 to 90 per cent, the ideal humidity for many plants. This is its principal advantage. Because of its location, the light intensity is low and the temperature too high for many plants. However, some of the shade plants requiring high humidity do well in this case. For use on dark or short days the case is provided with 80 watts of fluorescent lighting, installed above the top.

Unfortunately for the plants, my personal preference for temperature is on the warm side. The only adjustment possible in respect to the temperature factor, is to confine most of the plants to the cooler window areas.

Author photo

A window in the author's apartment—summer arrangement. During the heating season the plants in the front row are moved nearer the window. Plants to the rear stand on slatted wooden rack over metal tray filled with water.

Reflected Light

Although I have not explored the value of reflected light, I do try to increase it, in the hope that it will benefit the plants. I have used white paint on the racks, water trays, and ease.

Soil and Fertilizers

For potting soil for most plants I use about 2 parts of average garden soil, 2 parts of peat (usually Michigan peat), 1 part of sand, a sprinkle of coarse ground charcoal, and 1 teaspoonful of agricultural limestone to every quart of the mixture. The lime apparently counteracts the acidity of the peat.

For newly rooted cuttings, I add to this mixture some peat and some vermiculite. For African violets, ferns, certain begonias such as *B. rex, B. imperialis,* and *B. goegoensis,* and some other plants, I add an extra part of peat and a little more sand. Leafmold can be used in place of the peat, but should be free of disease and well decomposed. Leafmold that is not well broken down will burn the roots.

Though many gardeners include fertilizers when making up their potting mixtures, I do not use them at that time. I prefer to use them later, because I think it gives me better control of the feeding program.

For heavy and fast-growing foliage plants, I like to use a fertilizer high in nitrogen with a formula of the proportions of about 10-6-4. For flowering plants, I like a formula high in potassium but lower in nitrogen, about 5-10-5. How often I feed a plant depends on the size, rate of growth, and the extent of the root system.

Author photo

Glassed-in case with overhead fluorescent light fixtures.

Gas

As is well known, gas for cooking and heating is destructive to plants. Though the city dweller living in a multiple apartment house may take precautions to prevent leakage of gas in his own apartment, he can do little to prevent leakage that may reach his home from the apartments of his neighbors. The best insurance is frequent ventilation without direct draft on the plants.

Pests

Most of the pests that I have had to contend with were brought in on newly acquired plants. Though a visual examination will reveal some insects, if present, the eggs that may be on the plants or in the soil are difficult to detect. For this reason, I quarantine newly acquired plants for at least a month.

A few of the most troublesome pests are mites (cyclamen mite, broad mite, and common red spider), several species of plant scale, and root and leaf nematodes. I get good control of red spider mite with nicotine sulphate or rotenone. For scale, I like Volck's oil spray for those plants that are not damaged by oil. For broad mite I use fine dusting sulphur.

I have not found it worthwhile to treat plants infested with cyclamen mite and leaf nematode; I destroy these plants. To get rid of root nematode, I take top cuttings from infected plants and after washing them thoroughly with water, start new plants. The remainder of the infested plant is destroyed. Because of the danger to humans and some young or tender plants, I do not advise the use of sodium selenate (by amateurs) for the control of any plant pests.

Water

Several years ago, I experimented with the use of rainwater for watering plants. So far as I could determine, it offered no advantage over New York City tap water.

Though I use water rather generously, none of my plants suffer from too much water at the roots. For those who are too handy with the watering can, my practice of using plenty of drainage material in the bottom of a red clay pot, filled with a loose, porous soil mixture, is advised. Unless the gardener is a good judge of the moisture needs of a plant, he should avoid glazed pots without a drainage hole, pots too large for the plant, heavy clay soil mixtures, and the practice of watering on dark and sunless days.

To grow handsome house plants in a city apartment does require extra care, but I, for one, have found the rewards well worth the trouble.

SELECTING CHRISTMAS PLANTS

Jay S. Koths

THE poinsettia has been a symbol of Christmas for many years. The large red bracts surrounding the tiny red and yellow flowers appear about Thanksgiving and reach their maximum development just before Christmas.

Poinsettias flower at Christmas because they are responsive to day length. When days are long during the summer, the auxin balance within the plant is such that all growth is vegetative, producing leaves and stems. When days grow shorter, the auxin balance changes. Cells are formed which will produce bracts and flowers.

A very definite length of day is associated with this change. Poinsettias set their buds when the days reach a length of about 11 hours, 50 minutes. This occurs between October 1 and October 10 in Connecticut, depending upon atmospheric conditions at sunrise and sunset and upon varieties. Setting bud at this time, they will flower between December 10 and 25.

Regrettably, this results in a plant which is passing its peak, rather than approaching it when Christmas arrives. To overcome this fault, some growers supply supplemental light from September 20 to October 10 to be certain that flowers are initiated late enough to be in their very best condition at Christmas. This is indicated on the plant at Christmas by the presence of the small flowers in the middle of the red bracts. They should not appear old and some of them should still bear the hair-like stamens. A plant in this condition should remain in good condition longer in the home.

Green leaves to the bottom of the plant are another indication of good health and proper growth. Ferns usually are set in the pot with a poinsettia to fill out the plant in the event that some bottom leaves are lost.

Quality in other flowering plants at Christmas is not as difficult to ascertain. A cyclamen with its round leaves and oriental appearing flowers held inverted above the foliage will show its vigor at a glance. A quick peek below the leaves will disclose the number of buds remaining to supply future flowers.

The Christmas begonia, in the opinion of many, surpasses all other plants at this season in perfection and mass of bloom. Because it is fragile, care must be taken to obtain one which has not been mishandled. Additional care must be given later to keep this plant blooming.

Christmas cactus is common. And when looking for one, do not expect to find a specimen such as might have been found years ago in a front parlor. A small plant in a 4-inch pot may be two years old. This slow growth increases the price but enables one to grow the plant from year to year.

Kalanchoes are related to the succulents and cacti. Their leathery leaves are slightly notched and the plants are crowned with brick-red flowers. The flowers persist for some time and can be removed so that the plant may be used as a foliage plant when the flowers are gone.

GARDENING UNDER ARTIFICIAL LIGHT

Peggie Schulz

WHETHER your favorite house plants are African violets, begonias, cacti, gloxinias, miniature roses, orchids, or a host of other kinds, they may be grown and arranged under artificial lights to make an attractive indoor garden. In this way many areas in your home can be made more interesting, such as dark basement playrooms, attics, halls, corner cupboards, or a windowless wall. In many instances, plants grown in such locations under lights have better symmetry and produce a heavier floral crop than window-grown plants.

A simple light set-up consists of two 48-inch, 40-watt daylight or white tubes, or a combination of one daylight and one white tube, plus a reflector to direct the light down on the plants. Reflectors may be purchased or homemade of white painted plywood. Use a chain or pulley to suspend the lights directly over the plants at varying heights or mount the light tubes and reflector inside a wooden frame. (See illustration.) Suspend the lights about 18 inches above a plant table. With a set-up such as this you can make delightful garden combinations with taller plants, such as potted fruit, small hibiscus and anthurium, set directly on the table. Shorter plants, such as African violets, gloxinias and oxalis, should be placed on glass bricks or inverted pots and boosted so that pot rims are 8 to 11 inches from the tubes.

If fluorescent lights alone do not give all the light necessary, increase the light intensity by adding one 25-watt incandescent bulb for each fluorescent tube installed. The incandescents furnish additional red rays, which help promote good plant growth. However, most indoor gardeners have discovered that the incandescents also raise the temperature and decrease the humidity.

Give flowering plants 12 to 16 hours of artificial light each day. Foliage plants, such as philodendron and ivy, grow beautifully when they receive 4 to 6 hours of artificial light each day. You can purchase an automatic timer to switch lights on and off or you can be your own switchman.

After awhile one can tell at a glance which plants need more or less light. When stems are long and willowy and blossoms are few, plants need more light. Boost these plants closer to the tubes. When foliage bleaches, the plants are getting too much light and should be moved farther from the lights or the lights should be left on for a shorter period of time.

Light-grown plants require the same good culture that is given window-grown plants. Most pot plants grow well at 70 to 75°F. during the day, with a 10 degree drop at night. If humidity can be kept high, a somewhat higher temperature will be all right. Try to maintain humidity at 40 to 50 per cent. This factor is most difficult during the winter when homes are artificially heated. Increase the humidity by setting plants over trays filled with moist sand or pebbles, or grow your plants inside a lighted glass case. Good air circulation helps to promote healthy plant growth. If you grow plants in a poorly ventilated area keep a small fan going several hours each day.

Water plants thoroughly from top or bottom with room temperature water, then don't water them again until the topsoil feels dry. If you are in doubt as to when to water, lift the pots—if they are heavy they need no water, but if they feel light, then water.

Fertilize growing plants once or twice a month depending on the type of soil and the natural growing season. A weekly

spraying with a house plant aerosol bomb will prove to be good insurance against thrips, red spider and mealy bugs.

Plants growing directly under lights do not need to be turned to keep their symmetry although plants growing toward the edges of the tubes may need an occasional turning.

The center 12 inches of the tubes produce the strongest rays. Here, then, is the perfect place to grow colored-leaved geraniums, bulbs, gloxinias, and miniature roses.

African violets require 300 to 600 foot candles of light, depending on their size and type. Set plants in 4-inch pots so the pot rim is about 11 inches from the tube, with darker colored violets (blues and purples) nearest the center of the tubes. Space the white and pink flowered types toward the end zones of the lights where the light is weaker.

Gloxinias grown in 4- or 5-inch pots can be placed so that pot rims are about 8 inches from the tubes.

A friend of mine grows cattleya and cypripedium orchids under 40-watt fluorescents in the winter and vacations them in trees during the summer. The bloom she obtains from her light-grown orchids is as profuse and lovely as any grown in greenhouses.

While many growers confine their under-light gardens to basements and attics, there are others who enjoy plant set-ups that combine beauty and utility. A lighted planter and bookcase in our living-room is one of my favorites. It is 52 inches long, 30 inches high, and 18 inches deep. The plant shelf is 19 inches from the top of the cabinet. The area below the plant shelf is a bookcase for colorfully jacketed gardening books. (See illustration.)

Lights installed under a cabinet in my study furnish light for gesneriads such as gloxineras, episcias, and streptocarpus.

Mr. and Mrs. Bruce Thompson inspect light-grown gloxinia hybrids in their basement light setup.

Thompson

Author photo

Combination planter and bookcase.

For gardeners who desire ready-made planters, there are portable carts with one to three lighted shelves and several types of portable units with one pair of 30- or 40-watt lights. (See illustration.)

We like to use a portable set-up to finish the forcing of spring-flowering bulbs, to start tuberous begonias, caladium, for rooting cuttings, or to sprout annual or perennial seeds. (See illustration.)

Artificially lighted shelves are ideal for growing African violets, begonias, gloxinias, and other gesneriads from seed. Sprinkle the dust-like seed on moistened sphagnum moss, vermiculite, or sponge rock. Cover the top of the container with ventilated plastic or a piece of glass and keep it at 72 to 75° F. Some growers like to set the planter under the lights after planting but this isn't necessary if you keep a close check for germination.

When you spot the first greenery, it is time to give the seedlings their full quota of light. All of these small seedlings grow best when placed 4 to 5 inches from the light tubes. When the seedlings have four good leaves, transplant them to a community pot or flat filled with your favorite growing medium. Leave the lights on at least 12 hours a day to encourage sturdy flat growth. Given optimum care it is possible to bring light-grown African violets and gloxinias into flower in six months. *Begonia semperflorens* will bloom under lights in three months from planting time. Miniature roses grown from seed will flower in as little as seven weeks after germination.

For gardeners who dislike the task of planting fine seed, there are pre-seeded planters on the market that arrive fully planted with their own ventilated covers and watering trays. And the amateur who likes to get a head start in his garden will enjoy watching the growth of any of the pre-seeded annual planters.

Plants propagate rapidly under lights. Dip cuttings in a rooting hormone and plant them in your favorite starting medium. Slip a ventilated plastic bag over the pot or pan to minimize the need of watering. Place the pot 4 to 10 inches from the lights, depending on the size of the cuttings. Leave lights on as long as recommended for flowering plants.

I have two marvelous propagators I like to use for underlight propagation. One is a large plastic box and lid made especially for plant propagation; the other is a plastic covered bottom-heated propagating box.

If you want to carry on a plant hybridizing program you'll find lights of great value to you. Some of our finest single and double gloxinias have been bred by

Bruce Thompson of Philadelphia, Penna., in his basement light set-up (illustration, p. 13). Sheldon Reed of St. Paul, Minn., has produced dozens of excellent saintpaulia hybrids in his basement lighthouse. I have numerous *Gloxineras* (crosses between *Rechsteineria* and *Sinningia*) which have been originated and grown under lights. An Oregon grower of note reports that he starts all of his azalea seeds under lights. I have started seeds of iris, hemerocallis, lilies and roses under lights indoors, then moved them to the outdoor garden.

But my favorite arrangement of the moment contains native orchids, tiny wild ferns and miniature *Sinningia pusilla*. Miniature roses add sparkle and fragrance to this delightful under-light garden.

A plant cart equipped with fluorescent and incandescent lights is the home of nearly 150 orchid plants in a New York city apartment.

Thomas Powell

Hyacinth and amaryllis growing under a portable light unit in the author's kitchen.

Author photo

Gilchrist

This "tree" is, of course, not really a tree at all. It is the woody skeleton of a dwarf Japanese maple planted with epiphytic bromeliads. Planting consists of wrapping the roots with osmunda fiber and then attaching the wrapped root ball firmly to the tree with galvanized wire or nylon string. If the cups formed by the leaves are kept filled with water all the time, and if the osmunda and leaves are sprayed daily with water, new growth will be encouraged and holdfast roots will form. As the bromeliads get larger, the tree will become more natural looking.

POTTED TREES FOR MODERN INTERIORS

Ernesta D. Ballard

CONTEMPORARY houses and offices, with their broad expanses of glass, are well suited to growing plants, and often need masses of foliage to relieve their austerity. To satisfy this need, growers are producing increasing numbers of tropical trees in pots and tubs. In my experience, these trees make more satisfactory decorations for spacious modern interiors than the split-leaved philodendrons or the totem poles of *Philodendron cordatum* often sold for the purpose. True, trees are likely to be more of an investment — sizable greenhouse-grown specimens are costly to produce and southern-grown trees are expensive to ship—but they are also easier to care for, and they will retain their attractive appearance much longer.

When you first consider an indoor tree, don't be discouraged if it does not have foliage all the way down to the pot. The bare base of a philodendron totem is admittedly unattractive, but the trunk of a tree, clearly defined and often interestingly shaped, gives the tree character and stability.

Consider, also, the container. This need not be the cumbersome, graceless pot in which most plants are sold. For the plants pictured in this article, comparatively small pots were chosen to complement the plant in color and proportion. The decorative effect is heightened by covering the soil with moss or pebbles.

Of course, a hand-crafted Japanese pot can be expensive. However, it is perfectly possible to keep a tree growing in the same container indefinitely, if the roots and top are pruned at intervals, as described farther on in this article. Thus, the pot can be considered a long-term investment.

Be sure to buy a pot with a drainage hole. Jardinieres and planters without drainage holes should be used only if the tree is already in a pot with drainage and this in turn is placed on a layer of pebbles or crocks inside the jardiniere. Even with this arrangement, care must be taken never to fill the jardiniere with water above the bottom of the interior pot. If the roots of any plant become waterlogged, the plant will die.

If you are not a skilled horticulturist, seek expert advice in deciding what species of tree to buy. Generally speaking, if the place selected for the tree is sunny, your choice is wider and can include flowering and fruiting species such as the orange. Locations without strong light are suitable only for dark green foliage such as the fiddle-leaved fig and the *Schefflera* which grow naturally in the shady forests of the tropics. Bear in mind that it is the amount of natural light that controls your choice; artificial light is almost never adequate for year-round growing. Out of the fourteen species of trees described here, at least one will fit almost any location indoors where plants might be grown.

As an indoor tree grows from year to year, new growth will appear at the tips of the stems and branches, and the older, lower leaves will yellow and eventually drop off. How long this takes depends largely on the species. Leaves have lasted four years on my fiddle-leaved fig, while those on my orange tree rarely last more than one.

Pruning Methods

At some point, pruning will be necessary to keep the tree to a reasonable size and to encourage new branches along the

stem to replace fallen leaves. In the axil of every leaf there is a bud capable of developing into a branch. On most trees these embryo branches can be induced to develop by pruning the tips of existing branches and the main stem. Tip pruning developed the numerous branches on the fig illustrated. In the case of flowering and fruiting trees, pruning also produces more and better blooms and fruit. Palms alone will not respond to pruning. If you cut the growing tip out of a palm tree, the stem will die.

Pruning principles are the same indoors as out. If two branches cross, one should be eliminated; dead wood should be removed; crowded branches should be thinned out so the basic pattern of the tree is clearly visible; and a balance should be maintained between the roots and the top. Your eye, your sense of design, and your courage will help you decide where to cut.

Root pruning is as important as top pruning in the care of potted trees. Every year or two, I remove my trees from their pots to see if the roots are crowded. If they are, I loosen and untangle those on the outside of the root ball for an inch or two; prune the untangled roots away; and replant the tree in its container, using the basic soil mixture given on page 6 to fill the space around the reduced root ball. Poke the new soil into place with a stick to be sure no air spaces are left, and soak the soil thoroughly when you are through.

Concurrently with root pruning, a corresponding amount of foliage and branches must be removed from the top of the plant to compensate for the lost roots.

All plants—and trees are no exception—fall prey to pests. If the decorative effect of your potted tree is not to be spoiled by the sticky residue of scales, mealy bugs, and aphids, or by the yellow mottling of spider mites, you must spray regularly with a proper insecticide and miticide such as those discussed on page 94. The use of acrosol bombs makes spraying much less messy than it used to be, but it is not always practical for large trees. If bombs are not feasible, the tree should be in a location where a regular spray will not stain wall paper, curtains, or inaccessible glass, or else it must be small enough to be moved into a suitable place for spraying.

The best way to keep your tree alive and beautiful, and to safeguard your investment, is to put it outside for at least two months between May 15 and September 15. The increased light is often all that is required to induce budding and the development of new foliage. But, except for trees that have been growing in full sun inside, don't make the change too abruptly. Move the trees gradually from

Berggran

Howeia forsteriana. The hardiest of the potted palms. Here three plants have been grouped in one container to get a fuller effect.

the comparative dark of indoors to high, dappled shade and finally to full sun, taking ten days to two weeks for the complete transition. In the case of jungle plants, stop when you get to high, dappled shade. Don't ever put them in full sun. If high shade is not available, the north side of a building will do just as well.

The following are a few generally available trees I have found satisfactory. There are, of course, many others that will do well indoors. Included also is a so-called "bromeliad tree," which is not a tree at all but a stump planted with bromeliads. It will be just as satisfactory as a tree in many locations.

Schefflera actinophylla. Two plants which have been planted and grown together as one. The container is a light fibrous material that allows some passage of air and moisture like an unglazed clay pot. These pots are sold without drainage holes, but the material is soft enough to make boring a hole an easy job.

Citrus

Citrus trees—oranges, lemons, limes, calamondins, kumquats, and tangerines—are among my indoor favorites, for they are seldom without either sweet-smelling flowers or ripening fruit. Oranges, lemons, limes, and tangerines grow 4 or 5 feet high over a period of 10 to 20 years. Calamondins and kumquats stay small and can scarcely be classed as trees. Be sure to get a plant that has been propagated vegetatively. Seedlings seldom bloom.

Ideally, citrus trees should have 4 to 5 hours of winter sun, 6 to 8 hours of summer sun, and night temperatures ranging

Ficus lyrata. This plant is about 15 years old, and has six branches. The tub may seem small, but the plant is healthy and vigorous, indicating that the balance between roots and top is proper.

Gilchrist photos

anywhere from a winter low of 35°F. to a summer high of 80 to 90°F. One of the water soluble chemical fertilizers, formulated for use on potted plants, should be added to the water once a week from January to October. Most citrus that I have grown bear fruit heavily every other year and sparsely in alternate years. Twelve to 14 months elapse between flowering and the falling of the fully ripened fruit.

Chrysalidocarpus lutescens

Areca palm, cane palm, butterfly palm

This graceful, clump-forming feather palm is widely grown in all parts of the world. It is not as tough and undemanding as the kentia described farther on, but, to my way of thinking, is far more graceful. Native to Madagascar, it is a true tropical and should not be subjected to temperatures below 60°F. if it is to grow well.

A location near a window which receives strong light (though not necessarily sun) throughout the day, monthly applications of a water soluble fertilizer, and attention to the minimum temperature requirement are the main prerequisites for attractive palms.

Grevillea robusta. Silk-oak. A specimen plant which has been pot grown for 15 years. The glazed pottery container is Japanese. It was made with a fine large drainage hole 3 inches in diameter. The soil surface is covered with polished Japanese stones.

Coffea arabica — Coffee tree

Coffee trees will grow in many living-rooms. While they are not naturally handsome, their leathery, green leaves and arching branches lend themselves to pruning and some shaping. They are definitely not shade plants, but I have seen fine specimens growing indoors near windows which do not face east or south. If they receive 3 or 4 hours of sun a day in the winter and spring, they should bear waxy, white flowers which become true coffee berries. Those that get less light in winter flower in the summer if they are put outside. Actively growing plants should be fertilized every 2 weeks with a water soluble fertilizer.

Coffee in tree size is rarely seen for sale, but seedlings and small plants grow fast and may easily reach 4 feet in as many years.

Cordyline marginata — Dracena

If you like a lush, ferny mid-Victorian look in your house trees, you won't like this plant. Its bare, angular stems terminating in tufts of narrow grey-green leaves edged in purple give it a dramatic, modern effect. Very good winter light, preferably sun, and night temperatures no lower than 60°F. are essential. Since growth is slow in winter, spring and summer fertilization is enough.

Ficus Fig, rubber tree

This genus contains at least four species suitable for house trees in poorly lit corners. They will all withstand considerable fluctuations in temperature and irregular watering. In winter, when they are in a state of suspended animation, they should be watered thoroughly about once a week and never fertilized. When they are outside in the summer, they need large quantities of water and fertilizer and some filtered sun, or bright north light. Late summer is the time to expect new leaves and branches.

Ficus lyrata is a large masculine type of plant with enormous fiddle-shaped leaves; *F. elastica* is the well-known rubber-plant. Both make handsome trees. *F. retusa* (*F. nitida*) is quite different from the first two mentioned. The leaves are small, about the size and shape of mountain-laurel. Culture is the same as for the large-leaved species.

Grevillea robusta Silk-oak

The silk-oak, which is not really an oak at all, but a member of the tropical Protea Family, is a feathery, fast growing tree—an excellent selection for any sunny location indoors. The airy foliage does not block light from the rest of the room, and the stems and branches can be cut or bent with wire to make the tree assume any desired shape. Once this tree has reached the desired height, prune and cut it as much as you want. Dormant buds will readily develop into new leaves and branches to replace those that turn yellow and fall or are trimmed off. As long as there is new growth, do not be alarmed if some of the old is lost. Each leaf lives about one year.

Fertilize silk-oaks every two weeks or so from January to October, water them as often as the soil gets dry, and be sure that the container used drains easily and quickly.

Howeia forsteriana Kentia palm

If you want a care-free tree, this is it. Like most palms, it is durable and insect resistant, not set back by high or low temperatures, will grow in sun or in poor light, and can be left quite dry for days at a time. While it is often planted 3, 4, or 5 to a pot, I prefer it with its natural single trunk. Mature plants are very handsome with their straight, smooth trunks holding up an arching canopy of dark green fronds.

Gilchrist photos

A 30-year-old, house-grown orange tree (*Citrus* hyb.) planted in a black cedar tub. The tremendous weight of the fruit has pulled some of the branches down considerably below their normal position. Note the leather strap supporting branch in the middle of the tree.

Podocarpus macrophylla Maki

Podocarpus has small, dark green leaves and is a slow-growing, trouble-free indoor tree. Most of the large plants sold in the north have been grown outdoors in Florida or Southern California. Growers often put two or three tall, skinny plants in one container to give a bushy effect. A single specimen is much more decorative. When you buy, look for a tree with a good trunk that can stand alone. To keep it looking full and compact, prune 2 or 3 inches off the ends of all the branches once each spring.

If your indoor location is bright and sunny, fertilize podocarpus monthly from February to September. If the location is near a north window or receives only comparatively little light, wait until summer to fertilize.

Rhapis excelsa — Lady palm

The graceful, clump-forming lady palm from Southern China is one of the best small house trees I know. It is quite different from the other two palms mentioned here, the difference being mainly in the slender, reedy stems, covered with dark brown fiber, and the short, fan-shaped leaves. Specimens often grow to 5 or 6 feet, but you probably will not be able to buy one more than 3 or 4 feet high. They grow slowly and need fertilizer only 4 or 5 times during spring and summer.

In winter, keep the lady palm in any well lighted place indoors. It will not be adversely affected by cold drafts, but avoid temperatures below 50°F.

Gilchrist

Podocarpus macrophylla Maki. A good example of attractive potting in a 12-inch terra cotta pot. The soil surface is covered with thick green moss gathered in the nearby woods.

Schefflera actinophylla — Umbrella tree

The whorls of dark green leaves, large in proportion to the trunk, give the umbrella tree an imposing appearance. This tree, 5 to 6 feet tall, is strong and bold enough to be used as decoration in a very large room or entryway where a smaller, more airy tree might be out of scale with the surroundings.

Plants are available in a wide range of sizes. Usually 2, 3, 5 or more plants of different heights are set in a single container. It is very difficult to induce branching in scheffleras. When the top of a trunk is cut off, a single new shoot develops just below the cut and soon grows to replace the tip that was pruned away, leaving a barely visible scar.

The better the light, the better the plant will do, but winter sunlight is not entirely necessary. A water soluble fertilizer should be applied monthly from spring to fall.

UNUSUAL HOUSE PLANTS

Some different, beautiful plants and how to grow them

Helen B. Farnham

WHY not add a few exciting new house plants to your tried and true favorites? Growers specializing in rare plants offer an amazing array of beauties from which to choose, and while some call for "green thumbs" others are easy to grow.

For a modern interior, few plants can surpass the decorative bromeliads, with their symmetrical forms and unique leaf colorings. Often grown in osmunda fiber, they seem to do just as well in a mixture of equal parts of fibrous loam, leafmold, peat moss, and sharp sand, with small bits of broken charcoal added. Good drainage is essential, so be sure not to over-pot and to have plenty of crock in the bottom of the container. Water is given sparingly at the roots in winter, more freely in summer, and the leaf cups kept filled with water at all times. Don't plant too deeply. The basal part of the leaves should be above the soil. Good light is neeessary for best leaf color but strong sun may burn the foliage. Most bromeliads prefer filtered light.

Cryptanthus beuckeri has pointed, spoon-shaped leaves of pale green mottled with darker green. It provides a decorative note for low tables as does *C. zonatus,* with wavy leaves transversely marked with bands of cream and brown. The variant *C. zonatus* var. *viridis* has "zebra" bands of silver and green. Not to be overlooked is *C. bromelioides tricolor,* a taller grower, with green leaves striped and edged with ivory-white. Tints of rose are added to this combination, making it lovely indeed. The flowers of these plants are white and stalkless, nestling in the center of the plant.

Vriesia carinata has a fascinating flat spike of scarlet and yellow bracts. The plant is dwarf in habit and forms a rosette of pale green shiny leaves. There is also a lovely hybrid × *mariae,* larger than *V. carinata.*

Aechmeas are handsome plants. From Brazil comes *A. pineliana,* a dwarf type with a rosette of leaves in shades of gray, rose, and coppery green, their margins edged with brown teeth. The flower stem has red bracts and a brush-like head of yellow flowers. The light green leaves of *A. fasciata* are irregularly banded with silver-white, and from the center of the rosette comes a lovely head of pink bracts and blue flowers. *A. orlandiana* is also showy. A rosette of yellow-green leaves mottled with chocolate and edged with black spines produces an orange spike and ivory-white flowers in winter.

If you delight in miniatures try *Tillandsia ionantha.* Only 3 or 4 inches high, the narrow silvery-green leaves form a tight rosette, turn bright red, and blue-violet flowers appear. This bromeliad prefers some sun. Tillandsias seem to grow better in osmunda fiber.

Neoregelia carolinae tricolor (Brazil) is choice. Leaves of glossy green with lengthwise bands of white, tint pink when grown in good light. At flowering time they shorten, becoming red, and violet flowers appear in the center. The color remains over six months.

Billbergia blossoms are fleeting but the plants can be good in form and color. *B. saundersi* has bronze-green leaves thickly spotted with creamy-white and pink. The flowers are blue and the bracts crimson.

After a bromeliad blooms it will not do so again, but new offsets form and these may be cut off and potted.

African violet (*Saintpaulia*) enthusiasts have probably become well acquaint-

ed with episcias by now. Way back in 1947 the Massachusetts Hortieultural Society held their first house plant show and it was there that *Episcia cupreata* was judged best specimen in the "Vines and Hanging Plants" class. Since then, so many species and hybrids have beeome available that it becomes difficult to make a choice. Would you have red, pink, white, blue, or yellow blossoms? Today, among episcias, you ean find all of these, plus handsome foliage in shades of green, copper, and brown. Sometimes the eolors are combined, as in *Episcia reptans* 'Lady Lou.' This has bronze, green, and pink leaves veined with silver. It is considered diffieult to grow. *E. dianthiflora* has small green leaves with a purple mid-rib and fringed white flowers. A lovely new one, listed as 'Pearl,' also has white blooms, and it is considered easier to handle. The flowers of 'Tropical Topaz' are yellow and the foliage hairy and pale green. *E. lilacina viridis* has velvety green leaves traeed with silver and beautiful blue flowers, while the foliage of the hybrid 'Pinkiscia' is metallic bronze with green veins touched with silver and covered with pink hair. Pink flowers enhanee this one.

When growth is aetive, episeias like plenty of water. During Deeember and January they usually rest and require less. Don't, however, allow them to beeome overly dry. They also appreeiate warmth and the temperature should not drop below 55°F. or damage results. An east window should be tried if flowers are wanted, north light produees beautiful foliage, but good light is neeessary at all times. Easily propagated from stem cuttings or stolons plaeed in vermieulite, sand, or water, you are assured of a plentiful supply of episeias. Pot them in the soil reeommended for bromeliads.

A collection of Bromeliads.

Roche

Columneas are interesting relatives, members of the Gesneria family. *C. glori-osa* is a trailing vine with small leaves covered with red-brown hair and large red flowers with an open yellow throat. The tubular flowers of *C. tulae* are smaller and pure yellow, borne in the axils of the small soft green leaves. East light seems to be desirable.

Hoyas are excellent house plants and they may be used as climbers or trailers. Try *Hoya carnosa* 'Exotica' trained on cork bark where the leaves, in two shades of green surrounding a creamy center flushed palest pink, show off to good advantage. *H. motoskei* is a free bloomer, its broad oval leaves spotted with silver. An umbel of star-like flowers, pinkish-cream with maroon center, adds beauty to this one. Sometimes I think the dwarf *Hoya bella*, a native of India, is my favorite. This is best grown in a hanging pot so that one can look up and see the exquisite waxen-textured blossoms. They are white with a lilac-pink center and usually appear toward early spring and summer. This is the period of active growth and water should be applied freely at this time. Growing time also calls for the application of fertilizer. During the winter months less water is given, for too much at this time may destroy the roots. The soil should be porous, and the pots small, as hoyas bloom better when pot-bound. When flowering is over allow the spurs to remain, for next year's fragrant blooms will be borne on them.

If there is a cool room in your home try *Ligularia kaempferi aureo-maculata* or *L. k. argentea* in an east or west window. The first has a round green leaf blotched with yellow and it is sometimes known as leopard-plant. *L. k. argentea* is rare and lovely. The blue-green leaves may be edged with white or unevenly variegated white and silver. Occasionally, leaves are pure white. Both have yellow daisy-like blooms. No special soil mixture is required and only light applications of fertilizer supplied when the plants are in active growth, lest the leaves become too large. Divide for more plants.

Genereux photos

Peperomia 'Emerald Ripple'

Aphelandra squarrosa, a choice plant to grow in a warm room.

Ligularia kaempferi aureo-maculata

Hoya bella

The Spiderwort family offers many easily grown plants. *Callisia elegans* (*Setcreasea striata*) has small succulent deep green leaves with silvery-white stripes, the underside flushed purple. Flowers are small and white. The long, narrow green leaves of *C. fragrans* (*Spironema*) are blotched with brownish-purple in strong light. Rosette in form, the plant sends out runners that terminate in more rosettes. Tiny fragrant white flowers are borne on tall stems. No special potting mixture is needed for these plants and they prefer filtered sunlight and moist soil.

On the other hand, the trailing *Cyanotis kewensis* needs sunshine, and it must be grown a little on the dry side during the winter rest period. The small fleshy green leaves of this plant are entirely covered with woolly brown hair, the underside purple and the flowers blue-violet.

Siderasis fuscata (*Tradescantia*) is a fine house plant, decorative in form and foliage. The rosettes grow in clusters and the broad oval leaves are olive green with a silvery band in the center, flushed purple beneath and entirely covered with brown hair. The blue-violet flowers are fairly large. Filtered sunlight is preferred and this, too, is given less water when resting.

Genereux photos

Hoya carnosa 'Exotica'

PLANTS FOR HANGING BASKETS

Olive S. Hull

WHEREVER hanging baskets are used, they add grace and beauty! Imaginative use of them is fun, and personalizes your home. Perhaps your nameplate is attached to a tree at the entrance to your driveway. Have you ever thought of suspending a plant there too? To herald the summer season, why not attach a hanging pot to your lamp post? Hanging plants may be used in sheltered doorways or on a porch or patio. A foyer is another suitable place for pendulous plants. Columneas do well in indirect summer light. *Columnea tulae flava* benefits from the filtered light of polyglass panels flanking the main entrance.

The humidity of a kitchen presents an ideal atmosphere for indoor gardening. A breakfast nook may be adorned by *Aeschynanthus pulcher.*

Heavy plants, such as *Spathiphyllum floribundum,* are displayed to advantage when grown in a floor standard. Enthusiasts add a solarium to their dining room in order to have room for innumerable specimens.

The selection of plant material is endless. There are the well-known begonias, browallia, ferns, ivies, ivy geraniums, oxalis, peperomias, philodendrons, plumbago, and tradescantias. Less familiar are the many varieties and cultivars of abutilons, bromeliads, campanulas, cacti and other succulents, gesneriads, kalanchoes and orchids. Once the decision has been made to plant a basket, why not grow an exotic one?

Begonias

Such a large number of begonias are sold for baskets that there is no need to mention them by name. Have you discovered that some upright begonias persist in drooping? Stop staking them! Examples are the angel-wing or Orange Rubra; the rhizomatous 'Maphil,' and several semperflorens, including 'Ernest K.' which is an exquisite hybrid introduced by the late Ernest K. Logee of Danielson, Connecticut. Its leaves are glossy and dark; its flowers are double and almost red.

Easy-to-grow *Begonia schmidtiana* has interesting hairy leaves and is floriferous. Its dainty flowers are white and single. Its native habitat is Brazil. Cool nights, high humidity, strong but indirect light and drastic pinching in its early stages of growth and after blooming are essential. Propagate from branched stem cuttings taken from the base. New baskets should be started every other year. Place plenty of drainage in the pot before adding humus-rich, porous soil, which should be slightly acid.

Cacti

None of the many forms of *Rhipsalis* will be discussed. Do investigate them if you are unfamiliar with them. Instead, the cherished Christmas cactus (*Zygocactus*) which so often refuses to flower will receive our attention.

In lieu of grafting a Christmas cactus to an upright cactus, let it grow naturally. Small plants are pleasing when set in high compotes; medium-sized ones make pretty hangers. Heirlooms are more secure in standards.

Buds should form in the fall, provided:

(1) the plant was fertilized regularly during the period after blooming when new foliar growth was evident;

(2) the night-time temperature is in the low sixties (55°F. the rest of the year);

(3) the plant has short days—a maximum of 11 hours at this time of year. This means that it should not be located in a room that is used in the evening because artificial light interrupts the long night that is required.

Author photos

Christmas cactus

Columnea microphylla (note flowers in lower part of picture).

Christmas cactus welcomes a shady spot on the porch in the summer. This is preferable to putting it out-of-doors where pests take their toll. In the summer rest period, keep it as cool at night as possible; furthermore, this is the only season when it should be kept quite dry. Immediately after flowering, a good pruning will prevent rank growth and result in a greater profusion of blossoms.

Fuchsias

Fuchsias, grown both as hanging and staked plants, date back to our forebears. Since that era, however, hybridization has eliminated combinations of clashing colors. Of the almost limitless cultivars, try growing such single-flowered ones as 'Butterfly,' with its red blooms, and 'Galli-Curci,' with its pink corolla surrounded by sepals of a deeper intensity.

The double-blossomed fuchsias are more flamboyant. 'Berkeley' has lovely rose sepals and corolla. Among double-flowered varieties that may be trained into tree or basket form are 'Easter Bonnet' which is pink, 'Southgate' which is a two-toned pink, and 'Swingtime' which has the handsome combination of red sepals and a white corolla.

Fuchsia devotees are assured of continuous bloom by propagating throughout the year. Terminal cuttings from the lower sections seem to produce vigorous plants. These will need to be transplanted often since pot-bound fuchsias are unhappy. Regular applications of weak fertilizer, lots of water, cool nights, pinching during growth and after flowering, a dryish rest period, and frequent renewal of plants are recommended.

Gesneriads

Unusually exotic, but lesser known with the exception of *Achimenes*, are the hanging gesneriads. Why not try any one of the following fibrous-rooted ones?

Natives of Asia, *Aeschynanthus pulcher* (lipstick plant) and *A. lobbianus* are similar except for the color of the calyx. The nickname is an obvious one, for each red flower emerges from its calyx looking like lipstick in an opened case. The many clusters of bloom and the shiny firm leaves make an extremely colorful basket.

Codononthe crassifolia was introduced to cultivation from tropical Panama. Its

Episcia cupreata 'Acajou'

Geranium 'Sunset Ivy' is admired for its green, white and pink foliage. ⟶

chains of glossy vigorous leaves are its key attraction. Don't be alarmed by the red spots on the undersurface of the foliage. This is an interesting characteristic. While its white velvety flowers last only about a day, it is almost always in bloom.

Columneas

There are well over 100 columneas, and more and more are being grown. These American tropical plants have graceful foliage—and all blossom, too! Insignificant are the flowers of *C. tulae flava* (yellow) and *C. linearis* (pink), but even these are treasures because of the profusion of bloom. Large spectacular flowers give distinction to *C. gloriosa* (red), *C. hirta* (orange), *C. microphylla* (reddish orange), and *C. arguta* (yellowish orange). The latter two have dainty foliage.

Episcias

The divers episcias should be grown more widely. This genus also is of tropical American origin. *E. dianthiflora* has lacily-fringed white blossoms and small leaves and stolons.

Another species, *E. punctata,* has speckled white blossoms. It is a challenge to grow this one well. *E. reptans* and *E. lilacina* have a puckered type of foliage with distinctive markings. The former has red flowers; the latter rarely blossoms.

Three excellent hybrids are 'Acajou,' with silvery greenish foliage and an abundance of red blooms; 'Emerald Queen,'

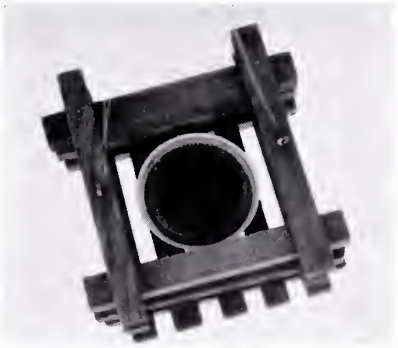
Young fuchsias, grown either as upright or hanging plants, flower profusely most of the year.

with lime leaves and coral flowers; and 'Filigree,' with captivating rich leaves and true red flowers.

Two alluring episcia hybrids which demand more warmth, higher humidity, better drainage, and less light are the variegated-leaved 'Lady Lou' and 'Ember Lace.' The stolons should be removed from all episcias frequently. Stolons may be propagated, treating them as stem cuttings.

Hypocyrta

Two hypocyrtas make attractive hanging baskets. One is *Hypocyrta nummularia* from Mexico and Central America.



Redwood basket with saucer and pinholder constructed by author.

This grows beautifully in a 3½-inch pot. Ours sheds its leaves in summer; in midwinter it is covered with orange pouches.

Hypocyrta strigillosa is a much larger plant. Its prime fascination is its gracefulness. Its flower pouches are tiny by comparison, but the plant is a joy to a house plant enthusiast.

Streptocarpus (Cape primrose)

Perhaps the common name for *Streptocarpus* evolved from its primrose-like textured foliage. Countless species and hybrids are available. They are easy to grow from seed, as simply as any of our annuals. Mature plants can be increased by dividing the crowns. The Wiesmoor hybrids have blossoms resembling petunias, although more elongated and longer lasting.

Streptocarpus require a cool (as low as 50°F.) night-time winter temperature. During the semi-dormant period they should be kept as dry as possible without wilting.

Culture of fibrous-rooted gesneriads is uncomplicated. They need porous, humus-rich soil, good drainage, and should never be allowed to become dry or pot-bound. Regular feeding, good housekeeping (spraying), and temperatures of 65°F. at night are essential. Give them strong but indirect light.

Ivy-Leaved Pelargoniums

Ivy-leaved geraniums are a pleasure to grow. Three of the many favorites are: 'L'Elegante,' perhaps better known as Sunset Ivy geranium, which is grown principally for its tri-colored green, white and pink foliage; 'Mrs. Banks,' whose white flowers are edged with blue; and 'Charles Monselet' with blooms of a glorious red.

Geranium culture is well known: cool nights, ample sun, well-drained soil, and good pruning. Fertilizer low in nitrogen should be given to pot-bound plants.

There are numerous ways of hanging pots. One drawback to the modish containers obtained in gift shops is lack of provision for drainage. To overcome this, place a minimum of an inch of stone chips in the bottom of the flower pot. Then place a pinholder in the container to raise the pot above any water that may collect there.

Try several propagations in a strawberry jar. Remember the hazard of overwatering is very great with a container of this kind; therefore, use as much drainage material as space permits.

Extremely decorative are redwood baskets. Ours are homemade. For household use, place a pinholder in a saucer before inserting your flower pot.

For greenhouse use, where dripping is unobjectionable, redwood baskets may be lined with fine screening. In turn, these may be covered with sphagnum before filling them with soil. Two other methods for the greenhouse are (1) to attach orchid hangers to clay or plastic pots and (2) to line wire baskets with redwood fiber or sphagnum and plant directly into them.

100 HOUSE PLANT PORTRAITS

A Guide to Successful Culture

People acquire house plants for a variety of reasons. But whatever the reason for their selection, successful culture depends upon choosing the right plant for the right place.

Important factors in house plant culture are water, light and temperature, and to a lesser extent, humidity. Soil watering and house temperature can be controlled but, except for supplemental artificial light, the uncertainties of sunshine in many situations make the problem of light a variable one.

The 100 house plants pictured here, and the cultural directions that accompany them, are arranged primarily on the basis of their light requirements for satisfactory growth. The special categories at the end are for unusual situations.

Naturally, since plants are living things, the classification is not as rigid as it might seem; many of the plants could as well be listed under several of the headings.

For information on soil mixture and general care, see "Basic Principles of Growing House Plants" on page 4.

MINIMUM MAINTENANCE REQUIRED

These plants can be recommended for growing in the most difficult situations, or for growing under better circumstances by those whose green thumb talents are underdeveloped. Dust, gas, and neglect seem to be acceptable to this life-tenacious group of plants.

Aglaonema modestum
(Chinese evergreen)
Shade; can be grown for months in water only.

McFarland

Aglaonema oblongifolia curtisi
(Chinese evergreen)
Some moisture in air desirable; if too tall, top can be cut and rooted in sand.

Rothschild

Rothschild

Chlorophytum elatum
(Spider plant)
Moderate light; keep moist.

Rothschild

Coleus blumei (Coleus)
Many colors, brighter if given some sun; easy to root; guard against mealy bug.

Crassula oleracea (Jade plant)
Sun; not much water required. True identity of this species has been confused; also referred to as "argentea" and "arborescens."

Rothschild

Dieffenbachia picta
(Dumbcane)
Needs some moisture; if too tall, top may be cut off and rooted in damp sand.

McFarland

Graf

Dracaena deremensis warnecki (Dracena)
Water freely; watch for mealy bug; if too tall cut off top and root in damp sand.

Rothschild

Fatshedera lizei (Fatshedera)
Good general purpose plant; do not over-water; resistant to mealy bugs.

Ficus elastica (Rubber plant)
Any exposure; wash or spray leaves occasionally; propagate by air-layering.

Buhle

Ficus lyrata (Fiddle-leaf fig)
Any exposure; wash leaves occasionally; propagate by air-layering.

Buhle

MacDonald

Hedera helix hahni (Hahn's self-branching ivy)
Keep moist, but do not over-water; moderate light.

MacDonald

Hypoestes sanguinolenta (Measles plant)
Easy to root; grow between 60 and 70° F.; prune back, and root cuttings when plant gets leggy.

Impatiens sultani (Touch-me-not, snapweed)
Easy to root; flowers well only if kept cool.

Maranta leuconeura kerchoveana (Prayer plant)
High humus soil; spray leaves occasionally.

Roche

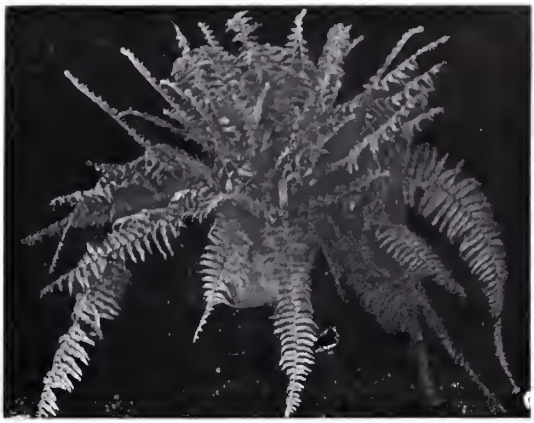
Roche

Buhle

Monstera deliciosa
(Mexican bread fruit)
Any exposure but avoid direct sun; moist atmosphere desirable; spray leaves if possible; do not over-water.

Pandanus veitchi (Screw-pine)
Tolerant of most home conditions.

Rothschild



Buhle

Nephrolepis exaltata var. **bostoniensis** (Boston fern)
Rich soil; avoid direct sun.

Peperomia capreata
'Emerald Ripple'
Prefers moderate light; do not over-water.

MacDonald

McFarland

Peperomia sandersi var. **argyreia**
(Watermelon peperomia)
Moderate light; does well in terrarium.

Roche

Philodendron oxycardium
(Philodendron "cordatum")
Moist atmosphere desirable; avoid intense light.

Pilea cadierei (Aluminum plant)
Easy to grow; needs sun; prune back when leggy and start new cuttings.

MacDonald

Pilea involucrata (Pilea)
Easy to grow; tolerant of moderate to low light; high humus soil; do not over-water.

MacDonald

Buhle

Pteris cretica var. **albo-lineata** (Brake fern)
Rich soil; moist air.

MacDonald

Podocarpus macrophyllum (Podocarpus)
Soil mixture, 3-2-1; keep soil moist, but do not over-water; 60-70° F. temperature.

Sansevieria 'Hahni' (Hahn's sansevieria)
Grows well under all conditions; do not over-water, especially in winter.

MacDonald

Sansevieria trifasciata (Snake plant)
Grows under all conditions; avoid over-watering, especially in winter; tolerant of gas.

Buhle

Roche

Scindapsus aureus (Pothos)
Slower-growing than philodendron; tolerant of gas.

Syngonium podophyllum
(Syngonium) mature form
Keep moist; spray leaves.

Buhle

Roche

Syngonium podophyllum
(Nephthytis)
Juvenile form, often sold as *Nephthytis;* some shade; tolerant of gas.

Tolmiea menziesi
(Pick-a-back-plant)
Easy to grow but watch for mealy bug; tolerant of gas.

Buhle

PLANTS THAT DO BEST WITH MODERATE LIGHT

Generally speaking, there are the east and west window plants, which seem to do best if the light is neither too strong nor too weak. Are there exceptions in this classification? Yes, of course, but other things being equal, the plants illustrated here are intermediate in their light requirements. Other plants with similar light needs are *Astilbe japonica*, many begonias, bromeliads, *Epiphyllum* spp., *Eucharis grandiflora*, *Torenia fournieri*, many palms, Christmas cactus.

Aechmea (Air pine)
Plant in osmunda fiber; keep roots on the dry side in winter, but keep water in the "vase" of leaves; tolerant of gas. Many other relatives of this plant make fine house plants.

Roche

Asparagus plumosus (Plume asparagus fern)
Water freely; keep cool in winter if possible.

Buhle

Buhle

Asparagus sprengeri (Asparagus fern)
Plenty of water; feed liquid manure every 2 or 3 weeks when actively growing; keep cool.

Begonia semperflorens (Rose begonia)
Rich soil; keep moist but well drained.

McFarland

Rothschild

Begonia foliosa
Rich soil; keep moist but well drained.

Caladium bicolor (Caladium)
Plenty of water when growing, quite dry in winter.

Roche

Genereux

Cissus antarctica (Kangaroo-vine)
Will grow in poorly lighted places; keep soil moist.

MacDonald

Cissus discolor
Moderate to strong light; rich soil; do not over-water.

Cissus erosa (Cissus)
Keep constantly moist while actively growing; guard against mealy bug.

Roche

Cyperus alternifolius (Umbrella plant)
Grows in any soil, but must be kept wet.

Buhle

McFarland

Dracaena godseffiana
(Dracena)
Fairly tough; withstands neglect; smaller than other dracaenas, seldom more than 1 to 2 feet.

Roche

Hoya carnosa (Wax plant)
Use same soil as for ferns. Keep moist and warm during late winter and spring, dry and cool during fall and early winter; tolerant of gas.

Peperomia griseo-argentea
Do not over-water; feed well.

MacDonald

Saintpaulia ionantha (African violet)
High humus soil; low light; keep soil moist.

Roche

HIGH HUMIDITY PLANTS

As a group, these plants have a high humidity requirement. Others in this general classification are the terrarium plants such as *Asparagus plumosus*, small begonias, croton, *Pilea microphylla*, and most ferns.

Buhle

Adiantum cuneatum
(Maidenhair fern)
Rich soil; does best in terrariums; not easy; avoid sprays containing DDT.

McFarland

Ardisia crenata (Coral berry)
Keep moderately cool in winter (60°F.); tolerant of gas.

Rothschild

Calathea ornata 'Sanderiana'
(Sanders calathea)
East or west exposure; moderate water; fairly easy.

McFarland

Ficus pumila (Climbing fig)
Tolerant of warmth or cold; water well, do not allow to become dry; watch for red spider mites.

Ficus radicans var. **variegata**
(Variegated rooting fig)
Tolerant of warmth or cold; water well, do not allow to become dry. ——→

McFarland

McFarland

Fittonia verschaffelti
(Fittonia)
Shade; needs abundant soil water, but do not overwater; does well in terrarium.

Buhle

Saxifraga sarmentosa ⟶
(Strawberry plant)
High humus soil; moist.

Helxine soleiroli (Baby's tears)
Water from the bottom; good for terrarium.

Buhle

Buhle

Selaginella uncinata
(Blue selaginella)
Rich soil; does well in terrarium; needs deep shade to bring out blue sheen.

PLANTS FOR COOL PLACES

The plants illustrated here grow most satisfactorily if both day and night temperatures are relatively low. At low temperatures, they can stand considerable light. Others in this general classification include *Araucaria excelsa, Camellia japonica, Campanula isophylla.*

McFarland

Capsicum frutescens var. **conoides** (Tabasco redpepper)
Easy from seed; when in fruit keep in the sun; moist.

McFarland

Cyclamen **persicum**
(Florists cyclamen)
East window; keep moist; water from the bottom; rest in summer.

McFarland

Episcia cupreata
(Flame violet)
Small bulbs; start in vermiculite, then rich soil in pots or hanging baskets; keep quite dry after flowering until new growth starts again.

Buhle

Primula malacoides (Fairy primrose)
Best treated as an annual; sow seed from January to March for winter bloom, keep in shaded cold frame, bring indoors before frost; keep very cool.

Senecio cruentus (Cineraria)
Seeds sown in May for winter bloom, in August or September for spring bloom. Not easy.

Roche

Solanum pseudo-capsicum
(Jerusalem cherry)
Sunny window in winter, but keep very cool; give plenty of water; very sensitive to gas.

McFarland

PLANTS TOLERANT OF HOT AND DRY CONDITIONS

Many homes and apartments, human frailities being what they are, are kept both hot and dry. For such circumstances, the plants of the desert are best. They will stand from moderate to intense light, and it makes little difference if they are overlooked for a week or two by the watering can. So far as water is concerned, they are camels of the plant world. The ones given here are but a few of the large number in this category.

McFarland

Aeonium arboreum
(Aeonium)
Sun; sandy soil.

McFarland

Aloe variegata
(Kanniedood aloe)
Sun; sandy soil.

Buhle

Cryptanthus zonatus var. **zebrinus** (Zebra plant)
Sun or shade; pot in osmunda fiber or very well-drained soil.

McFarland

Echeveria gigantea (Echeveria)
Sun; sandy soil; moderate water in summer, very little in winter.

Gasteria "hybrida" (Tongue cactus)
Sun; sandy soil; give rest in winter.

Buhle

Haworthia planifolia (Haworthia)
Sun; sandy soil; give rest in winter.

Buhle

Rothschild

Kalanchoe daigremontiana
(Mother of thousands)
Sun; keep moist but do not overwater; propagated from small plants produced on the margins of the leaves.

Kalanchoe tomentosa
(Lamb's ear kalanchoe)
Sun; keep moist but do not over-water.

McFarland

Rothschild

Kalanchoe pinnata (*Bryophyllum pinnatum*) (Air-plant)
Sun; keep moist but do not over-water.

Kleinia repens
Sandy soil; full sun.

MacDonald

Branstetter

Mammillaria microcarpa
(Fish-hook mammillaria)
Sun; sandy soil; keep on dry side from October to March.

Branstetter

Notocactus leninghausi
Sun; sandy soil; keep on dry side from October to March.

Sempervivum (Houseleek)
Sandy soil; sun; little water but not too dry.

Buhle

Stapelia grandiflora (Carrion flower)
Sun; sandy soil.

Buhle

PLANTS FOR SEASONAL BLOOM

The plants pictured in this group bloom, for the most part, only during a particular time of the year. Culture conditions vary, therefore, depending upon the stage of bloom and rest period requirements.

Roche

Anthurium andraeanum
Rich soil or osmunda fiber; needs moist atmosphere and considerable light.

Roche

Begonia socotrana (Christmas begonia)
Begonia soil; keep cool; give plenty of light; water well but never allow to get soggy; propagated from leaves, but not easy.

Buhle

Begonia tuberhybrida
(Tuberous begonia)
Usually planted out-of-doors, but do well in north window or on shady porch; summer bloomers.

Clivia miniata (Kafir-lily)
Allow to become pot-bound; water enough in winter to keep leaves from wilting. Bring into light in spring, increase water, give liquid manure. Reported tolerant of gas.

Roche

Buhle

Camellia japonica (Camellia)
Rich soil; keep cool; give plenty of light; spray leaves occasionally with water; set pots outside in summer, in light shade; prune very little, immediately after flowering.

Epiphyllum
East or west window; rich soil; plenty of water while actively growing, less in winter.

Roche

McFarland

Euphorbia pulcherrima (Poinsettia)
Sunny window; moderate water; avoid dry air; sensitive to gas; short photoperiod from September to Christmas.

Roche

Fuchsia
Cool growing conditions; water well while actively growing, less water for 2 or 3 months after flowering.

Gardenia jasminoides veitchi
Rich soil; plenty of light but not hot sun; spray leaves regularly with water; not easy; grow between 62 and 68°F. night temperature.

Roche

Hippeastrum vittatum
(Amaryllis)
Give very little water until bud shows; then water and give liquid fertilizer during active growth.

Roche

McFarland

Kalanchoe blossfeldiana
Sun; keep moist but do not over-water; after flowering keep on dry side for 2 months; do not spray with DDT; needs short photoperiod from October to flowering.

Lachenalia tricolor (Cape cowslip)
Sunny window; cool and dry until growth starts, then water.

McFarland

Roche

Oxalis rubra (Oxalis)
Rich soil; little water and cool in winter, moist and sun in summer.

Roche

Rhododendron indicum (Azalea)
Rich soil. Put out-of-doors during summer; give sun, plenty of water and food. Bring indoors end of August or early September; keep cool as possible.

McFarland

Sinningia speciosa (Gloxinia)
Rich soil; moderate light; keep soil moist.

Zantedeschia elliottiana
(Golden calla)
Rich soil; water sparingly until growth starts, then give great deal of water. When leaves die back, give less water for 2 or 3 months.

Roche

Zygocactus truncatus
(Christmas cactus)
Plenty of sun and moisture when growing; give complete rest (no water) for 2 or 3 weeks in September, then resume watering; short photoperiod in fall.

Rothschild

PLANTS THAT NEED STRONG LIGHT

These plants thrive best in south windows, especially in winter. In summer, some may require thin shading from the direct rays of the sun. Many of them will grow almost as well in east or west windows, especially in bright, sunny climates. Amaryllis, begonias (in winter), bromeliads, most cacti, citrus plants, *Gardenia veitchi,* iresine, *Lantana camara,* and *Thunbergia alata* are among the plants not illustrated in this section which also respond well to plenty of light.

Roche

Abutilon pictum
(Flowering maple)
Prune in September to encourage winter flowering.

Roche

Beloperone guttata (Shrimp plant)
Flowers in winter; can be started from cuttings of young shoots; do not overwater.

Rothschild

Ceropegia woodi (Rosary vine)
Sandy soil; not much water.

Euphorbia splendens
(Crown-of-thorns)
Sandy soil; keep rather dry during November and December, but water moderately at other times.

Roche

Rothschild

Cyanotis kewensis

Endures heat; keep a little dry in winter.

Graptopetalum paraguayense
Strong light; low moisture; sandy soil.

MacDonald

Rothwell

Gynura aurantiaca (Velvet plant)
Must be kept quite moist; prune back when leggy.

Roche

Pelargonium peltatum (Ivy-leaved geranium)
Avoid dry air; keep cool in summer.

Pelargonium zonale
(Zonal geranium)
Soil mixture, 3-2-1; feed regularly; do not over-water.

McFarland

Veltheimia viridifolia
(Veltheim lily)
Flowers in winter; keep dry in summer, start watering when growth begins in fall.

Muller

AFRICAN VIOLETS

How to grow and propagate them successfully

Alma Wright

PROBABLY the most popular house plant we know today is the African violet (*Saintpaulia*). It is easy to grow, lovely to look at, and thrives under a variety of conditions in our contemporary overheated houses.

Success in growing beautiful, flowering African violets the year around depends on observing a few simple rules which, if followed, will provide window gardening pleasure throughout the year.

Propagation

New plants may be propagated at any time of the year by means of leaf cuttings, plant divisions, offsets or seeds. The most common method is by leaf cuttings. From a healthy plant remove a crisp, medium-sized leaf of good green color and with a razor blade trim the end of the stem back on a slant to about 1½ inches in length. To avoid bruising stem tissues, leaves should be cut with a sharp knife, never pinched or broken from the parent plant. Lay aside the cuttings for about 30 minutes for the cut stem ends to heal. Sound young leaves taken half-way between the center of the plant and the bottom are best because they root faster. Do not use the older outside leaves for they are too mature and spent.

Cuttings may be rooted in several different ways. To root a cutting in water, cover the top of a water-filled drinking glass or other container with a piece of aluminum foil fitted over the opening. Punch a hole in the foil and stick the leaf stem through the hole into the water. Place in a well-lighted window, but not in the sun. In two to four weeks roots should begin to show.

When these roots are ¼ to ½ inch long, and before small plants form, the leaf is ready to be planted. If preferred, cuttings may be left in water until small plants form. It is a matter of choice. Plant the rooted end of the leaf stem just under the surface, about ¼ to ½ inch deep, in a mixture of ⅔ damp peat moss and ⅓ damp vermiculite or sharp sand,

Cox photos

'Pride of Rochester,' boasts many full double light pink flowers above fluted foliage.

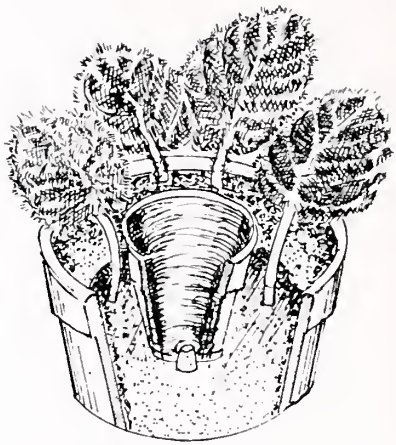
and support the stem with a plant marker or crossed toothpicks so that it will not wobble or fall over and the tender roots be broken off. After small plantlets appear and have grown an inch or so tall, carefully separate them from the mother leaf. If their root systems appear to be developed fully enough for good plant growth they may be separated and planted individually in 2-inch pots in a well-balanced soil mix. Plantlets with poor or insufficient roots should be returned to the rooting mix to grow better roots.

If several leaves are to be rooted you may prefer to use a wooden flat, aluminum pan, glass dish, or the pot-in-pot method and to plant the leaf cuttings directly in the growing medium without first rooting them in water. The peat moss and vermiculite mix with a few good-sized chunks of charcoal placed in the bottom of the pot or flat for drainage is recommended. Set the leaves out in rows, inserting each stem ¼ to ½ inch deep in the rooting medium. If the cuttings do not stand up properly after the mix has been firmed at the surface, brace them with plant markers or toothpicks. Care must be used in watering as the medium must not be allowed to dry out too much or be kept too wet while the leaves are rooting.

Another successful method is to plant leaf cuttings in a covered container. Battery jars, aquariums, or fish bowls are suitable. If one of these containers is used, place a thin layer of sterilized pebbles or broken charcoal over the bottom to provide artificial drainage. Then fill it to a depth of about 3 inches with the growing medium of peat moss and vermiculite or sand. Do not pack the mix down too firmly; level it lightly and leave it fluffy. Insert the leaf stem about ¼ to ½ inch deep in the growing medium taking care to press the mix firmly about the base of the cutting. Cover the top with clear plastic, Saran Wrap, or a pane of glass and place it in a well-lighted window that does not have direct sunlight. Provide ventilation by making a small hole in the plastic or Saran Wrap or insert a match stick between the rim of the container and the glass top. If the cover stays too misty, provide for a little more air. Cuttings rooted this way will not require much water but they should not be allowed to get too dry. An even humidity is the objective.

Propagation by rooting offsets (suckers) or dividing a plant which has several crowns is the quickest way to produce flowering plants. For offsets, gently pry the small plants loose from the old plant and set them to root in the growing medium. If they have not sufficient base to hold them steady in the mix, fasten them down

'Blue Chips' has black-green pointed foliage and a dark blue single blossom.



For the pot-in-pot method place a small, loosely stoppered pot in the center and keep it filled with water.

To root a leaf cutting in water, cover a water-filled glass with aluminum foil and insert the leaf stem through the foil.

with crossed plant markers or toothpicks until they have grown roots and are ready for potting. To divide a multiple crown plant, remove it from the pot and gently pull the sections apart without damage to the roots if possible. Plant each new crown separately, being careful to have the center of the plant free of any covering of soil. Do not plant too deeply or use a pot too large for the reduced size root system. Water moderately until new growth starts. You can re-root an old crown which has no roots by putting it in the growing medium until it develops an adequate root system.

Potting and Soil

When the young plants are about 2 inches high they are ready to be separated and planted into soil. If more than one plantlet is produced from the leaf the little plants should be gently worked apart and each planted in a separate pot. A plant that appears to be weak or one with a poor root system should be placed back into the rooting medium where it will develop a more complete root system and grow into a sturdy little plant before it is potted.

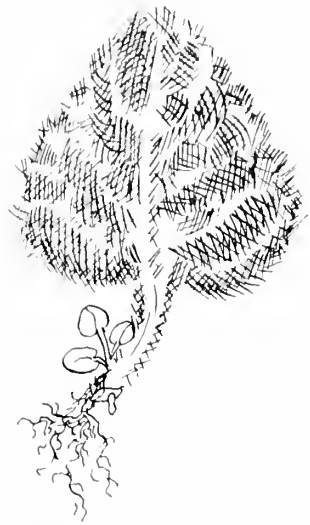
Water

African violets do not have to be watered every day but a daily inspection of the condition of the soil is necessary. Keep the soil only slightly moist to the touch. They may be watered from either the top or the bottom of the pot; the only requirement is that the water be warm. Regular watering will produce better bloom. Saintpaulias do not do so well when the soil becomes hard and dry, nor do they thrive if too wet—swimming is not for them. Common sense in watering a plant is the best rule to follow.

Light

Probably the most important factor of all in producing good growth and bloom is proper lighting. African violets will grow well in any window where they get plenty of light—but not strong sunlight. Plants must be kept out of the direct rays of the sun, except in mid-winter, when the mild light of the December or January sun

When roots are about ¼ to ½ inch long the cutting is ready to set out in the growing medium.



If preferred, a leaf may be left in water until small plants are formed before the cutting is planted.

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encourages growth and bloom.

Many African violet enthusiasts have turned to fluorescent lighting with marvelous success. Lights are placed about 12 to 15 inches above the plant table and are kept on approximately 14 hours a

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A. Use a pot about 2¼ inches across for each cutting. Set the cutting at a slant, giving young plant space to grow.

Watson from Monkmeyer

B. Most cuttings produce a cluster of young plants instead of a single crown. When they reach this size, divide them.

Gottscho-Schleisner

day. Tests have proven that 40-watt daylight tubes are about right for best results. A two-tube, 40-watt fluorescent fixture with one cool white and one daylight tube is recommended for good bloom. Additional incandescent light is desirable if the fixture is set up to permit the use of incandescent lamps.

Temperature and Humidity

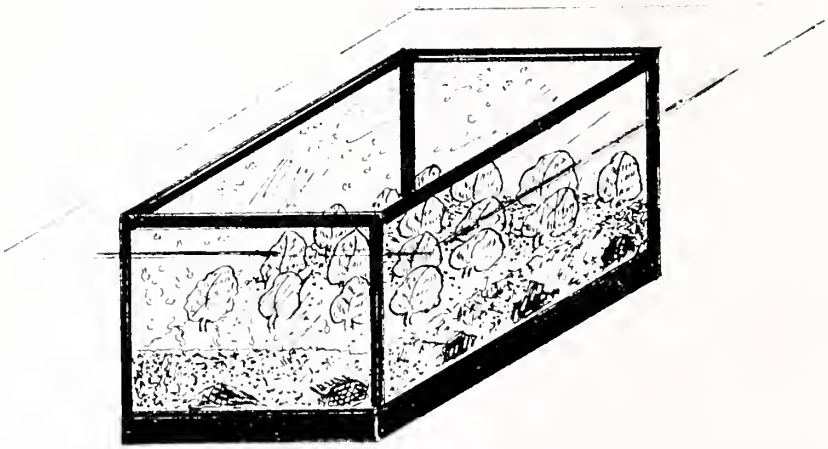
African violets will not thrive in an atmosphere that is too dry, too hot, or too drafty. An ideal room temperature is from 65 to 75° F. with a relative humidity of from 50 to 60 per cent. If the air is too hot and dry the buds may drop off or the blossoms will fall off shortly after they open. At too low temperatures, plant growth slows down, flowering may stop, and the foliage will not be nice and flat, but will curve down around the edge of the pot.

Humidity may be increased at plant level by grouping the pots close together, by placing them on moist pebbles in a shallow tray, or, in the case of a single plant in a clay pot, by setting the pot in a larger jardiniere. The jardiniere will hold moisture around the pot. To increase moisture in the whole room, pans of water may be placed on the radiators or other heating equipment.

Fertilizer

After plants begin to bud and bloom they should be fed with a complete soluble fertilizer about once a month. Do not over-feed; use as the manufacturer directs. If sheep or cow manure is preferred, apply it, in small amount, directly on the soil at the edge of the pot, or in liquid form when the plants are watered. Manure solution is highly praised by many experts. It is made by pouring boiling water over dehydrated manure. Let it stand several days, then dilute the concentrated solution until it is about the color of weak tea. Use for regular watering.

With these simple rules, anyone with a reasonably "green thumb" should succeed with African violets.



In using an aquarium or other covered container for propagation, place a thin layer of broken charcoal or sterilized pebbles in the bottom for artificial drainage. Cover with growing medium, and insert cuttings. Glass cover may be pushed back, as needed, for partial aeration.

Paper-white narcissus forces readily in pebbles and other growing media.

Roche

BULBS FOR INDOOR WINTER BLOOM

Elsie Ford Catlin

ONE of my most rewarding hobbies is bringing spring flowering bulbs into bloom indoors in winter. "Forcing" is the general term used for this though it is not correct. Actually, we try to treat the bulbs as close to nature's way as possible. This means giving the bulbs a long period of development outdoors for good root growth in a pit or coldframe held as near to 35 to 40°F. as possible. Freezing is not necessary or desirable; nor is it necessary to have a greenhouse. If one remembers that most of these bulbs grow in spring during cool days and cooler nights, the nearer one approximates that condition the better. Humidity is essential, also a sunless but well-lighted place where the bulbs can develop slowly after removal from the pit, in 55°F. temperature, or at the most 60°F. for ten days or more, depending on the variety.

If one's heat is hot water, steam, or hot air without introduced humidifying, 5-inch-deep copper trays with pea-size pebbles and water held at a level just below the top of the pebbles, will help immeasurably. Temperatures below 70°F. in the daytime and 60 to 65°F. at night will prove most beneficial. However, a warmer day temperature may be tolerated if the night temperature can be below 70°F.

Bulbs should be ordered early, particularly if one is using the "pre-cooled especially prepared bulbs" which can be brought into flower two or three weeks earlier than normal. There are several excellent forcing varieties which may be secured from many bulb houses, and florists usually carry them too. They are the Copland tulip varieties, rose and lavender, and 'William Pitt' which, when forced, is a beautiful rose red. "Precooled" daffodil bulbs may flower for Christmas too.

For forcing, one should purchase only large, top quality bulbs, with the exception of hyacinths. The second size hyacinth will produce a fluffier, less stiff flower head. Good growing conditions will improve the quality of bloom.

Never try to force the same bulb twice. It is sound practice after flowering to keep the bulbs in active growth—watering, fertilizing and giving sun or bright light until the leaves yellow. The bulbs should then be placed in a cool frost-free cellar or garage and planted outside as soon as the ground is workable. I have had better success planting them in May, June or July rather than in the usual fall season. The following spring they may not be top quality but will rejuvenate themselves the second year. Hyacinths treated this way will have a more graceful flower head than the tight bunchy flower of the first season.

Planting in pots can be done from early fall until December 15, but October 15 to November 1 is the ideal time. For Christmas flowering an earlier date must be used.

Soils for Potting

Good loam is the basis of the soil mixture. If the soil is too heavy add sharp sand and peat moss or leafmold. Do not use any raw manures with tulips since they may spread botrytis disease. Daffodils prefer slightly acid soil and they are helped by superphosphate. If one does not have good loam available, nurseries and garden centers do. Already mixed bulb soil may be secured from some greenhouses. If one's soil is acid, add ground limestone for bulbs with the ex-

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Planting paper-white narcissus bulbs for growing in pebbles and water.

ception of daffodils. One-half pound of ground limestone will neutralize one bushel of peat moss.

In my soil mixtures, I prefer dampened sphagnum peat which comes in plastic bags. I use only fresh-water sand, neither too fine nor too coarse. Old rotted cow manure is preferable, but if unavailable use commercial dehydrated cow manure. Bonemeal is an excellent source of phosphorus. In using fertilizer, one should remember that nitrogen makes stems and foliage, phosphorus promotes flowers, and potash strengthens stems and helps to resist disease.

Soil mixtures are as follows for forcing daffodils, hyacinths, tulips and small bulbs such as chionodoxa, crocus, grape hyacinth, scilla, snowdrop, and winter aconite (which should be planted immediately on purchase as drying of this bulb is very harmful).

Montague Free Forcing Medium:

6 parts loam
4 parts sand
3 parts leafmold
½ cup of bone meal per peck

F. F. Rockwell and Esther C. Grayson Forcing Medium:

⅓ sifted loam (if heavy add one-fifth sharp sand)
⅓ pulverized peat moss
⅓ sifted compost or well rotted cow manure

Add to each bushel: 2 quarts mixed, ⅓ bonemeal, ⅔ dried cow manure.

Peat moss may be substituted for leafmold. These measurements are by bulk, not weight.

I have very successfully used a mixture of 1 bushel excellent loam (in which enough sand and fibrous material have been incorporated) to which I have added to each bushel: 2 quarts mixed—⅓ bonemeal, ⅔ Driconure.

"Driconure" is a combination of dried cow manure and peat moss. For daffodils only, add a 3-inch flower pot of 20 per cent superphosphate per bushel of mixture. Hyacinths like a slightly alkaline soil.

Use bulb pans or the slightly deeper azalea pots. For daffodils and tulips, use 6-inch pots for three daffodils or six tulips, 7-inch for nine tulips, and 8-inch for 12 tulips. Late tulips will do better in azalea pots. I prefer a large 9- to 12-inch bulb pan filled with daffodils as the flowers are more effective. For hyacinths, use a 4-inch pot for one hyacinth bulb, a 6-inch pot for three, and a 7-inch pot for four. If possible, separate the bulbs by one inch although they may be planted almost touching each other and the rim of the pot.

Daffodil tips should show just above the surface. Expose hyacinth noses ¼ inch. Cover tulips with 1 inch of soil. Daffodils in the pit or coldframe will root sufficiently in 8 to 12 weeks; the longer period is preferable. Hyacinths take three months, and tulips 10 to 14 weeks. Roots should show excellent growth through the drainage hole or around the edge of the pot before being brought into the house. Tulips must have at least a 4-inch top growth and heavy roots regardless of the time element.

In potting, cover the hole with a broken piece of flowerpot, concave side down. Add ½ to 1 inch of flower pot chips, then ¼ inch layer of sphagnum moss to keep soil from sifting down and spoiling the good drainage which is most important in bulb forcing. Wash all old pots well to remove possible sources of disease. Soak new pots in water before using. Put enough soil mixture in the pot so that ½ to 1 inch is left for watering after the bulb is in place and covered. Tulip bulbs should have flat side toward rim of pot. Firm the soil well so that the bulbs will not force themselves out. Label each pot as to date and variety, and face the labels in the direction in which the pit is to be opened. Water thoroughly by standing pots in a pan of water until the surface shows moisture. Do not put the bulbs, especially pre-cooled ones, in the pit or coldframe on a day when the temperature is above 55°F.

The next step is to dig a pit in a well-drained spot if a coldframe or a cold root cellar is not available. My pit serves three

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A colorful dish garden for winter may be made of forced grape hyacinths and *Scilla sibirica*, both blue and white.

purposes. The soil taken out is used to hill up my roses for winter. When that soil is returned in spring, my house plants are sunk to the rim for the summer in that spot.

I have constructed a frame of fairly heavy wood 12 inches deep all around, similar to a coldframe with no glass top. This frame is set on the ground, and the outer edge marked with a straight-edged shovel. The frame is then temporarily removed while a straight-sided hole is dug into which the frame will slide, fitting closely with 3 to 4 inches protruding above the surface and 8 or 9 inches below grade level. After the frame is in place, dig out to a depth of about 2 feet total, putting in 1 foot of leaves (preferably oak which do not mat), topped with a ½ inch square mesh screening to support the pots and facilitate drainage in case of a very heavy rain. Earth is sloped up to the top of the outside of the frame to further improve drainage. The pots are then put in place. Leaves are packed between and above to the top of the pit frame, and watered well. A ¼-inch square mesh screening is then tacked in place to keep out rodents. Flower pots inverted over the bulb-filled pots will serve the same purpose. Daffodils are not bothered by rodents. Leaves of any variety are then put on the top of the mesh to a depth of 2 feet and extending well beyond the sides, and covered with a plastic tarpaulin. This keeps the leaves from getting wet and freezing, and helps in the removal of the pots.

My frame is long and narrow. I put in a group of different varieties, working from both ends, thus cutting down the number of staples I must remove and replace each time I open the pit. The center section is left to the last of the season. I open the pit about December 15 to water the pots if necessary, and I sprinkle the leaves on top of the pots within the pit as well.

If a coldframe is used, cover the pots with leaves, excelsior, or salt hay. If a frameless pit is used, put in 2 or 3 inches of drainage material on the bottom. Cover the pots with a layer of sand and then leaves or salt hay to a depth of 2 feet to keep from freezing. Cover all with a plastic tarpaulin. With this method, however, it is more difficult to keep out rodents.

Another method is to put pots in apple crates well surrounded by damp leaves or peat moss, and by leaves outside. Then cover with a tarpaulin and leave outdoors in a shady, protected spot. Rodents are a problem here also. The regulation 1⅛-bushel apple crate holds three 6-inch pots plus two of the 4-inch size.

After the allotted time for growth in the pit has passed, on a day above freezing, bring in several pots of different varieties (water the remainder if necessary), and place in a cool, well-lighted but sunless place with good humidity for a period of time at 55°F. minimum and 60°F. maximum temperature. I use shelves in front of a north, below-grade level areaway window in the cellar. The pots should be watered moderately during this transitional period.

If one wants taller, more loosely formed hyacinth flower heads, make a cone of cardboard 12 inches high. The bottom diameter of the cone will correspond with

the top of the pot and the top of the cone will be 5 inches in diameter. Place this on the pot to draw up flower heads to the light. Remove the cone when the desired height is reached.

When the bulbs have grown several inches and buds are showing, bring the pans to a sunny window to further growth. Increase watering somewhat at this time. Temperatures of 65°F. daytime and 55 to 60°F. at night will be preferable. If it is impossible to maintain a 65°F. day temperature, a cool place at night such as an unheated room will help to prolong the flowering period.

To estimate blooming dates, the following schedule may help although it is not entirely accurate. Tulips brought in from the cool pit after 10 to 14 weeks outside will force in February in five weeks at 65°F. temperature; in March, in four weeks. A lower temperature of 55°F. during the first week or two is preferable but will increase the time somewhat. Daffodils brought in after 12 weeks in the pit will force in about three weeks. Hyacinths brought in after 12 weeks will take a few days less than tulips. When the bulbs are in full flower, they should be moved out of the sunlight to prolong the flowering period.

Pre-cooled bulbs must be planted immediately on arrival and kept cool, or the process will be nullified. Pre-cooled bulbs will require considerably less time in the pit and will force sooner inside.

Pit culture of the small varieties of spring bulbs (chionodoxa, crocus, grape hyacinth, etc.) is similar to that for daffodils, hyacinths, and tulips. However, they must be kept at cool temperatures—50 to 60°F.—after they are brought in from the pit and even while flowering. Temperatures for snowdrops and winter aconite, even in the house, must never exceed 50°F. Crocus will go blind if forced quickly or at too high temperatures. Early fall potting is advisable. Crocus growth should be 2 inches high before bringing to the light and grape hyacinth, 3 inches.

Forced daffodils add a bright note to a conventional plant stand.

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Potting tulip bulbs

Roche photos

Covering tulip bulbs

After planting, pots of bulbs may be stored in a trench and covered over with earth. Inverted pots protect developing shoots. The author uses a covering of wire screen rather than inverted pots.

Roche photos

Pots of bulbs may also be stored in a box or cold-frame and covered over with mulch.

After burying in trench or box, a layer of hay or leaves is added for protection against freezing. Labels permit ready identification when bulbs are removed for forcing.

Roche photos

Taking sprouted bulbs from coldframe for forcing indoors.

Flowering Schedules of Forced Bulbs

Hyacinths

Variety	Color	Bring In	Expected Bloom
Bismarck	light blue	January 1	early February
City of Haarlem	yellow	January 1	early February
King of the Blues	dark blue	January 27	early March
*Lady Derby	salmon-pink	December 22	late January
*L'Innocence	white	January 1	early February
La Victoire	rose-crimson	January 1	early February
*Marconi	rose	January 1	early February
*Myosotis	pale blue	December 22	late January
*Ostara	dark blue	January 1	early February
*Pink Pearl	pink	January 1	early February
Queen of the Blues	light blue	January 27	early March
Queen of the Pinks	bright rose-pink	March 1	late March
Queen of the Whites	white	January 27	early March
Scarlet Perfection	red	January 1	early February

*Excellent.

Small Varieties of Spring Bulbs for Forcing

Crocus

Regular:

vernus Vanguard — ageratum blue; may be forced for Christmas

vernus Vanguard Violet—early

Dutch (large-flowered):

purpurea grandiflora—deep purple

Remembrance—soft purple-blue

King of the Striped—white striped blue

Snowstorm—white

Yellow Mammoth—yellow

Grape Hyacinth (*Muscari*)

armeniacum (Early Giant)—brilliant blue and fragrant

botryoides album—white

Old Blue—soft cobalt blue

plumosum (Ostrich Feather)—violet blue

Squill (*Scilla*)

sibirica (Siberian squill)—bright blue

sibirica alba—white

Tubergeniana—soft blue on a silvery ground; excellent forcer

In general, most of the small bulbs, if brought in in January or early February, will bloom in 3 to 4 weeks

Snowdrops (*Galanthus*)

Winter Aconite (*Eranthis*)

Small Flowered Hybrid Hyacinths		Bring In	Expected Bloom
Blue Star	deep blue	December 7	mid-January
Borah multiflora	lavender-blue	December 7	mid-January
Rosalie miniature	bright pink	November 10	mid-December
Vanguard miniature	light blue	November 26	late December

Early French Roman Hyacinths (Must be thrown away and not forced again. May be grown in soil or pebbles and water.)

Pure White	October 23	late November
Pink	October 23	late November
Blue	October 23	late November

Flowering Schedules of Forced Bulbs (*continued*)

Variety	Color	Bring In	Expected Bloom
Daffodils			
Trumpet Daffodils			
Aerolite	yellow	December 23	mid-January
*Beersheba	white	December 23	mid-January
** *Golden Harvest	golden yellow	January 1	early February
** *King Alfred	golden yellow	December 23	mid-January
Mrs. E. H. Krelage	white perianth primrose trumpet	December 23	mid-January
** *Mount Hood	white perianth cream trumpet	December 23	mid-January
*Rembrandt	golden yellow	February 8	late February
**Unsurpassable	yellow	December 23	mid-January
Pink Daffodils—large-cupped			
Mrs. R. O. Backhouse		December 23	mid-January
Large-cupped Daffodils (Narcissi)			
*Carlton	soft yellow	December 23	mid-January
*Deanna Durbin	white perianth, orange cup	December 23	mid-January
Dick Wellband	white perianth, flame-orange cup	December 23	mid-January
**Fortune	lemon-yellow perianth, red-orange cup	December 23	mid-January
John Evelyn	cream white perianth, frilled apricot-orange cup	December 23	mid-January
Small-cupped Daffodils			
Firetail	white perianth, crimson-scarlet cup	December 23	mid-January
Double Daffodils			
Mary Copeland	creamy white, lemon and brilliant orange	February 8	early March
** *Texas	yellow intermixed orange scarlet	December 23	mid-January
Twink	pale primrose center orange-red	December 23	mid-January
*Van Sion (*telamonius plenus*)	yellow	December 7	early January
Triandrus hybrids			
**Thalia	pure white	February 8	late February
Silver Chimes	white perianth, creamy yellow cup; cool conditions	February 8	late February
Cyclamineus hybrid			
*February Gold	golden yellow	January 1	early February

*Excellent.
**Precooled bulbs available.

Flowering Schedules of Forced Bulbs (*continued*)

Variety	Color	Bring In	Expected Bloom
Jonquil			
**Campernelli odorus rugulosus*	deep yellow	January 1	early February
Tazettas			
Cheerfulness (double)	creamy white, pale yellow center	February 8	late February
*Geranium	white perianth, orange-scarlet cup	January 22	mid-February
*Laurens Koster	pale yellow	December 22	mid-January
*Scarlet Gem	primrose-yellow perianth, orange-scarlet cup	December 22	mid-January
Poeticus			
Actaea	large white perianth, dark red eye	December 22	mid-January
**Early Perfection	white perianth, yellow cup	December 22	mid-January
Note: *recurvus* (Pheasant's eye) will not force			
Species Narcissi			
bulbocodium conspicuus, Hoop Petticoat		January 22	mid-February
Tulips			
Darwins			
**Bartigon	cochineal red, white base, blue ring	January 7	mid-February
Clara Butt	salmon-pink	January 24	early March
**Demeter	violet-blue	December 28	early February
Farncombe Sanders	geranium-scarlet	January 24	early March
** *Insurpassable	lilac-lavender	January 24	early March
Ossi Oswalda	white suffused cherry, red edge	January 24	early March
**Paul Richter	scarlet-red	January 7	mid-February
**Princess Elizabeth	soft rose, white base	January 24	early March
*Queen of Bartigons	salmon-rose	January 24	early March
** *Rose Copland	rose	December 28	early February
The Bishop	violet	December 23	late January
** *William Copland	lavender	December 28	early February
** *William Pitt	rose-red	December 28	early February
Zwannenburg	white	January 24	early March
Breeders			
Bronze Queen	apricot-yellow	January 7	mid-February
Indian Chief	reddish mahogany, flushed purple	January 7	mid-February

*Excellent.
**Pre-cooled bulbs available.

Flowering Schedules of Forced Bulbs (*continued*)

Variety	Color	Bring In	Expected Bloom
Cottage			
**Albino	white	January 24	early March
Carrara	white (force gently)	February 26	late March
Dido	salmon orange, shaded cherry red	January 7	mid-February
*Golden Harvest	yellow	January 7	mid-February
Mrs. Moon	canary-yellow	January 7	mid-February
Rosy Wings	salmon-pink	January 7	mid-February
Early singles			
*Fred Moore	terra cotta with golden-buff, orange-tinged, fragrant	December 28	early February
*DeWet	fiery orange stippled orange-scarlet	December 28	early February
*Proserpine	satin rose, white base	December 28	early February
Early doubles			
El Toreador	brilliant orange-scarlet	December 28	early February
*Murillo Max	rose flushed white	January 7	mid-February
*Peach Blossom	rose-pink	January 7	mid-February
*Schoonoord	white	January 7	mid-February
*Tea Rose	primrose-yellow flushed salmon	December 28	early February
Kaufmanniana tulips (Waterlily)	soft creamy white, center marked carmine-red	January 7	mid-February
Species			
Clusiana (Candlestick)	cherry-red, inner petals white	January 7	mid-February

*Excellent.
**Precooled bulbs available.

Hyacinths provide bright color and rare fragrance in winter. *Carl*

Epidendrum tampense, native of Florida

Roche

ORCHIDS IN THE HOME

Thomas Powell

THERE is a saying, "If you can grow African violets, you can grow orchids." Some enthusiasts would go so far as to say that success with almost any house plant augurs success with orchids!

As thousands of indoor gardeners have discovered, orchids are neither "fragile" nor "difficult." Indeed, one of the most interesting things about these beautiful plants is that they seem able to accommodate themselves, within reason, to widely varying cultural practices and environments.

A great many orchids will thrive on a windowsill, provided their three most important needs are met: *light*, *temperature*, and *humidity*.

Light. The epiphytic (air-growing) orchids like lots of light, but it must not be constantly direct and hot. A south or perhaps an east or west window, with the sunlight filtered through a thin curtain, is excellent. On dull days and in winter, the curtain can be removed. At all seasons, an abundance of morning and late afternoon sun produces the best growth.

The terrestrial or soil-growing orchids, such as the lady-slippers, thrive without any direct sunlight. They will do well placed farther back from the window or on the side where the sun's rays do not strike.

Thomas Powell

Cattleyas and cypripediums are two of the many orchids that do well under artifiical light or in a bright window.

The varieties of orchids that will thrive in a bright window are legion. More than 20 ← genera are represented here.

Patterson photo, courtesy American Orchid Society Bulletin

Temperature. Normal daytime temperatures in the home are fine for orchids. Most genera prefer a minimum night temperature between 55 and 60° F., which is easy to attain in most homes. But remember that it is usually quite a bit cooler near the window in winter than it is out in the room, so it's a good idea to check with a thermometer. Move the plants back from the glass if necessary, or better yet, tack or tape a clear plastic sheet over the window to act as an insulator.

Humidity. Ample moisture in the air is vital. Luckily, the required 50 to 70 per cent humidity is not hard to supply even in modern heated homes. You can mist-spray your plants daily with one of the atomizer-type gadgets available in garden supply stores.

Or, even easier, grow your plants on a tray in which an inch or two of pebbles supports the pots above water. Galvanized trays made by a tinsmith are fine, or you can make your own of the inexpensive sheet aluminum sold in hardware stores. A wooden tray may be lined with a plastic sheet to make it watertight. Some growers also hang a plastic sheet across the entire window area to form a sort of enclosed greenhouse.

Another solution is the miniature greenhouse or Wardian case. An enclosed case makes it simple to maintain the proper temperature and humidity. A number of these are on the market, or you can build your own. A tray for holding pebbles and water, plus glass walls and a glass roof, gives you a basic Wardian case. Refinements such as a thermostatically-controlled heating element and even fluorescent lights may be added.

However, be sure to provide for ventilation, as the atmosphere in an enclosed case is apt to become stuffy and overmoist. Orchids need fresh air to prevent rotting and other fungal diseases. Sliding doors or a hinged roof are necessary on Wardian cases, and for all home-grown orchids it's wise to occasionally open a distant window a crack even in freezing weather, to provide a change of air.

Best Kinds to Grow Indoors

Now, how do you start your orchid collection? Experienced home growers sug-

gest that you begin with mature, blooming-size plants of a popular genus such as *Cattleya,* the big showy corsage orchid. Later, when both your enthusiasm and experience have grown, very likely you will want to expand to other genera and to raising seedlings or even sowing your own seed.

Cattleya species recommended for beginners are *C. mossiae, C. gaskelliana, C. labiata, C. pereivalliana,* and *C. trianaei.* There are many others, of course, as well as thousands of hybrids that often boast more gorgeous blooms and greater vigor. The commercial grower from whom you buy your plants will be glad to suggest plants for a succession of bloom throughout the year.

Incidentally, contrary to popular belief, orchid plants are not expensive. While some extremely rare ones, or a few exceptional breeding plants, may bring fabulous prices, you can buy many good species and hybrids for from $5 to $10. Often their first blooming will give you flowers worth at retail as much as the plants cost.

Three other genera are especially well suited to home growing. *Laelias,* with starry-shaped flowers in many hues, are often found in their native habitat growing in windswept places where the days are hot and nights cool. Thus they are tolerant of the drastic changes in temperature and drafts encountered in the home. *Laelia anceps, L. autumnalis,* and *L. rubescens* are good choices.

Oncidiums, the delightful "dancing ladies" of the orchid world, have white or yellow flowers marked with brown and red. Some are miniature plants, others bear flower sprays several feet long. *O. cheirophorum* is a fragrant yellow-flowered miniature. *O. ornithorhynchum* bears dainty sprays of fragrant rose-purple blooms. *O. papilio,* the bright and unusual "butterfly orchid," often blooms almost all year long. *O. splendidum* produces heavy sprays of comparatively large flowers.

Epidendrums, too, come in all shapes and sizes and are very tolerant plants. One of the best is *E. tampense,* a native

Wm. Kirch Orchids, Ltd.

The cypripediums or "lady-slipper" orchids are a fine choice for the beginner. They do well in a north window without direct sunlight, and the waxy flowers are very long-lasting.

of Florida, which bears numerous short spikes of chartreuse blooms in spring.

You will soon want to get some of the dependable home bloomers, such as *Cypripedium maudiae,* the waxy green and white lady-slipper orchid. *Brassavola nodosa,* the white "lady of the night," is very fragrant after dark, and is one of the easiest to grow. *Cycnoches chlorochilon* has large fragrant swan-shaped flowers. Another beauty is *Odontoglossum grande,* the striped "tiger orchid." *Dendrobium nobile* bears lovely purple-spotted flowers in spring.

These are only a few of the popular orchids amenable to home culture. Dozens of other genera—*Phalaenopsis, Miltonia, Catasetum, Lockhartia, Maxillaria* and others—have proven their worth. Since there are approximately 30,000 species of orchids, plus countless hybrids, you have ample to choose from! Today multigeneric hybridizing is producing some spectacular plants that are wonderfully easy to grow. Crosses of *Epidendrum-Cattleya, Vanda-Angraecum* and *Sophronitis-Brassavola-Laelia-Cattleya* are some of these marvels of the plant breeder's art.

Water Requirements

All these beautiful plants, surprisingly, require less routine maintenance than many common house plants. Watering is the most important concern. Too-frequent watering is the most common cause of failure with orchids.

Wm. Kirch Orchids, Ltd.

Oncidiums are among the easiest of all orchids to grow. They prefer several hours of sun a day and a minimum night temperature of 55° to 60° F.

Wm. Kirch Orchids, Ltd.

Hybrids between cattlyeas and other genera will thrive in a south, east or west window. This is Diacattleya 'Chastity' (*Diacrium bicornutum* × *Cattleya granulosa*).

The osmunda (fern root) potting medium should be slightly moist—never soaking wet—while the plant is actively growing and when it is producing flowers. This may mean watering only twice a week or even less frequently. Keep the medium somewhat drier during resting or dormant periods. Plants potted in the new tree bark medium will need watering more often, as bark is less water retentive.

While each grower must work out his own watering schedule, a good general rule is to err on the dry side rather than the wet. Only terrestrial orchids such as *Calanthe, Phaius, Cymbidium* and *Cypripedium,* all planted in rich soil, like to be kept constantly damp at the roots.

Fertilizers

Monthly feedings of fish emulsion fertilizer supply ample food for orchids potted in osmunda. Those in bark, however, should be fed a high-analysis fertilizer with every second watering. Most growers use a 30-10-10 formula during the season of growth, switching over to a 20-20-20 formula when bloom time approaches. Repotting is usually done every two years, after flowering.

An outdoor vacation in summer will help plants grow sturdy and increase the quality and quantity of blooms. Put them on benches under an open tree—or hang them in the branches—where they will get filtered sunlight at midday, direct sun in early morning and late afternoon.

Recently, amateurs have reported considerable success growing orchids under artificial light. High intensities and balanced light are needed. Combinations of equal numbers of 40-watt standard cool white and deluxe warm white fluorescents, or of 40-watt standard cool white fluorescents and 40-watt incandescent bulbs, have proven satisfactory. Plants should be as close to the lights as possible without risking burning the leaves. The lights are kept on about 14 hours a day.

You can get lots of information from orchid books and growers, but the plants themselves will be your best teachers. A high degree of success depends upon observation, experimentation, and above all, patience. Some plants will acclimate themselves and grow and bloom dependably from the day you bring them home, while others may have to be moved around several times in your growing area until just the right conditions are found for them. Growing orchids in the home is a challenge, giving perhaps the greatest rewards of any indoor gardening project.

GLOXINIAS

How to grow and propagate them

Albert and Trudy Buell

AWAKENING among the charms of spring, the gloxinia (*Sinningia*), house plant of unparalled beauty, may without apology add her brilliant blossoms to complement Nature's outdoor loveliness. Such a color range as the hybrid gloxinia presents is a bit difficult to describe. All flower shades from delicate pinks to vivid reds are represented, as well as the darkest purples, the purest whites, and fine specklings on lightly tinted backgrounds. Throughout this gamut of color, the two types of gloxinia, bell-shaped and slipper-shaped, vie for admiration and attention.

The leaves of the gloxinia are both interesting and attractive. On some varieties they are extremely hairy, while on others they are nearly smooth. The size of the leaves varies a great deal, some measuring as much as 14 inches long and 10 inches wide.

Well developed plants of the larger kinds often have 40 flowers open at one time and one of our record plants has actually had as many as 102 blossoms showing at the same time. No other house plant offers such breathtaking reward for the effort spent in growing it.

Gloxinias are easily grown, and any flower enthusiast can achieve success in his efforts to produce gloxinias which have attractive foliage and admirable flowers. However, some skill is required to grow them well, and unlimited challenge is offered to the grower in the crossing of the different types and in waiting for the resulting seedlings to mature.

Soil

One of the first essentials is the preparation of the soil. We have found that gloxinias do best in a soil mixture that is rich and fibrous. A mixture of ⅓ good garden loam, ⅓ compost or leafmold, and ⅓ peat moss and sand in equal parts, has proven to be ideal for gloxinias. A 4-inch pot of bone meal is added to each bushel of this potting mixture, or a little less than a cupful to a 12-quart pail of soil mixture. Tubers that measure 1½ inches across or less should be potted in 5-inch pots. Tubers that are larger in diameter should be placed in 6-, 7-, or 8-inch pots. Good drainage is insured by placing 1 inch of crushed charcoal in the bottom of the pot.

Light

Light is probably the most important factor to consider in raising gloxinias. One of the growers' chief problems and the question they most often ask is, why do some plants become "leggy" or "spindling"? Almost always, this unattractive condition is due to insufficient light. Strange as it may seem, some plants require more light than others. Thus a plant which tends to be spindling should be given the sunniest spot possible. Occasionally, we have had certain plants continue their "leggy" trend until the sun became higher and the days longer sometime in March. Generally speaking, most gloxinias do best in a south or east window where they can receive every possible bit of sunshine during the winter months. Sometimes in the summer a bit of shade is necessary.

Leaf Cuttings

If the grower desires to produce tubers which will flower the following year he should start leaf cuttings in the spring and summer. Once in a while a cutting

Roche

Removing leaf of gloxinia to make leaf cutting.

Roche

Inserting gloxinia leaf cuttings in vermiculite for rooting. Center pot is filled with water.

that has been started in March or April will send up a shoot within six or eight weeks which will blossom during the same growing season.

We have found from experience that the leaf cutting should be taken as close as possible to the stem of the plant, where the leaf stem is hard. A leaf cutting having a hard stem will form a much better tuber than one having a soft, succulent stem.

Until quite recently, we used coarse sand for rooting our leaf cuttings. However, a mixture of half vermiculite and half native peat has more than proven its merit as a starting medium, not only for leaf cuttings but for gloxinia seed as well. In the house, especially in the dry atmosphere of a steam-heated home, a goldfish bowl or terrarium seems to be ideal for leaf cuttings. These containers keep the air around the cuttings continuously moist—which is helpful in producing plants of excellent foliage and abundant blossoms. The leaf cuttings will also root satisfactorily in an ordinary clay pot.

When a tuber develops at the base of a cutting, it is ready to be potted. First it can be put into a 4-inch pot and later on into larger pots, if necessary.

Gloxinia leaves may also be rooted by slitting them across the veins and placing them on the rooting medium. A plant

Roche

Stages in the rooting of gloxinia leaf cuttings. When tuber forms at base of stem, the cutting is ready for potting.

Left, gloxinia seedlings in germinating pot; right, larger seedlings transplanted to another pot.

Roche

should form at each break in the leaf. Still another method is to cut the leaf in sections, splitting the main vein. In both of these methods there is a risk of losing the cutting through decay. Neither method is to be recommended for choice varieties until experimenting has been done with leaves of the more common types. No matter which method of leaf propagation is chosen, the leaves should be taken from the plants while they are still a good, healthy, green color; i.e., while the plants are still blooming. Mature or rested tubers produce the greatest show of blossoms.

Water

Gloxinia plants should never be allowed to become water-logged. This is one of the foremost reasons for bud blasting or failure of the buds to develop fully. We advise applying water at the surface of the soil until it runs out of the bottom of the pot; in this way it can be determined how much water the plants have absorbed. They should not be watered again until the soil surface shows evidence of being dry.

Fertilizer

The amount of fertilizer required during the growing season will depend upon the fertility of the loam and leafmold which were used in the potting mixture. We have found that liquid fertilizer applied once or twice during the summer is adequate. This is prepared from one of the complete commercial fertilizers.

Rest

Beginning in September or October, gloxinias should be given a short rest. We repot the tubers as soon as the foliage dies down and before storing them for their rest period. The potted tubers can be kept in a basement or other dark place

Roche

Planting gloxinia tubers.

Roche

Cutting back gloxinia plant for new growth and flowering.

until new growth appears. They should be watered only enough to prevent extreme withering.

The nature of the individual plant will largely determine the start of the new growing cycle. Some tubers require only a short rest, or dormant period, while others are very slow in starting. We have had, occasionally, a tuber send up new growth before the old top dies down and we have found that such growth will produce just as fine a plant as if the tuber had taken a 2-month rest before growing a new top. If no growth of a plant is apparent within 4 months, the amount of water should be gradually increased.

Plants which produce an early crop of blossoms in the spring can be cut off just above the first pair of leaves and thus be made to produce another good display of flowers within 10 to 16 weeks. However, this second flowering may delay the next year's flowering until summer. In preparation for its rest the mature plant should be given less water.

Raising from Seed

Growing gloxinias from seed presents a never-ending field of experiment and anticipation. There is no particular difficulty involved and beautiful flowering plants will develop within 5 to 10 months. Seed that is sown in July produces the best results in our area. Any of the accepted methods of germinating fine seed and handling small seedlings will prove satisfactory. We use the following method. The seed pot is filled with a mixture of vermiculite and native peat, which is loose and lightly packed down. In the center of this we place a much smaller pot, the drainage hole of which is corked. The small pot is kept full of water which slowly seeps through its sides, keeping the planting medium in the seed pot moist. Under dry conditions, extra watering may be necessary, especially if the seed comes up and the seedlings are weak.

The seed will germinate within 6 to 10 days. As soon as the seedlings are large enough to handle, i.e., when they measure approximately ⅜ inch across the true leaves, they should be transplanted As the plants develop it is, of course, necessary to repot them into larger pots. A night temperature of about 62 to 68° F. is desirable during the fall, winter, and spring months. Only fresh seed should be planted because its viability decreases greatly after it is a year old. Seed that is sown in July should produce flowering plants the following spring and summer. By the time they are ready for their resting period they should have tubers measuring from 2 to 3 inches in diameter. These tubers, planted in November, produce the largest specimens we have ever grown or seen, although smaller tubers started in the fall will produce excellent specimen plants.

Pests

Thrips are the insects most likely to cause trouble. A rusty appearance of the leaf stems usually indicates their arrival. Their control is comparatively easy with DDT; its use every 6 or 8 weeks should eliminate the problem. DDT should be used with caution and as directed by the manufacturers.

Three other insects which may give considerable trouble to gloxinia enthusiasts are aphids, mealy bugs, and cyclamen mites. Aphids can cause a great deal of damage but they are easily controlled. The most effective spray for all types of

aphids is nicotine sulphate or malathion. Mealy bugs will sometimes attack gloxinias although they prefer other plants. We have been told that cyclamen mites can be stubborn pests although they have never been one of our problems; the new parathion sprays are reported to provide positive control. Aramite is used too.

There are many conjectures regarding the appearance of spots on gloxinia leaves and also leaves that suddenly die. Various things may cause these unsightly difficulties; some of the causes are unknown. The leaves of some strains of gloxinias turn black very easily and plants having buds that blast easily are also apt to be weak in this respect. If leaves of a plant that is in a warm, sunny window are splashed with cold water, they will often turn black. Also, if plants that are rather wilted are handled while in hot sun, their leaves will often show the same damage. If the plants recover, the leaves will have burned-looking spots on them. Although sometimes only the leaf's surface tissues may be broken by sudden temperature changes, more often the injury penetrates the whole thickness of the leaf. This type of spot does not spread and quite often the color will come back to a leaf suffering but slight surface injury.

Roché

One of the authors' own hybrid gloxinias which are noted for their large, richly colored flowers.

There is another type of leaf spot that is rather common and quite different from that just described. It is caused by a disease that spreads especially in cloudy weather when the humidity is high. When this condition exists, water on the leaves will spread the spores of the disease from one leaf to the next. Sufficient ventilation, so that moisture is not allowed to collect on the leaves, is the remedy for this kind of leaf spot. Also, any leaves that are in a dying condition, especially if they appear to have mold on them, should be removed and burned.

In our gloxinia breeding work we have not tried to produce plants which come true to color from seed by pollinating flowers on the same gloxinia. Such a practice as this would result in decidely inferior plants. Our chief goal has been rather to achieve an excellent assortment of colors on plants that are easy to grow. Consequently, after several years of careful selection and hybridization, most of our large-flowered gloxinia hybrids have blossoms measuring over 5 inches in diameter. Almost every color combination is afforded, with the possible exception of yellow, though some of the blossoms have throats that approach a near-yellow or cream color. Many of the blossoms are ruffled. Some flowers are exquisitely marked and delicately shaded, others are solid red or purple or have fused shadings and variations of color with contrasting borders. Still others are resplendent in spotless white, blending in beauty with those having varied colors for backgrounds.

There are gloxinias in the future for all who enjoy growing the less common plants.

CACTI AS HOUSE PLANTS

Henry Teuscher

CACTI make exeellent house plants, provided one realizes that they are sun-loving plants and treats them aecordingly. Actually, their whole life is governed by light to sueh an extent that the amount of light they receive determines how much heat and moisture they ean utilize or tolerate.

This means that in summer when eacti are growing and should be exposed to full sunlight, they ean stand any amount of heat. During this period they will benefit also from ample, twice-weekly watering.

During winter, when the light indoors —even on the window sill—is always poor, eaeti should be kept cool, to maintain the balance between heat and light. From November to February or March a light watering once a month is enough. A temperature of 45 or 50° F. is most satisfactory during this period. Cacti then go to rest while the small amount of water supplied prevents their shrivelling and saves their roots from dying. Actually, this rest is required to make them flower in spring.

Many amateurs make the mistake of assuming that since eacti are desert plants, they want to be hot at all times, not realizing that winter nights can be bitterly eold on most eaetus deserts. The window sill, directly over a hot radiator, certainly, is the worst plaee for a eactus plant in winter. One solution is to place eacti on glass shelves, suspended from above, direetly against the window pane, with the radiator beneath them shut off. This is quite satisfactory as long as the overall room temperature is not allowed to rise above 65 or 68° F. An excellent place for storing eacti over winter is an unheated attie which is free of frost. When at rest and kept rather dry, eacti require little light and most of them will then sustain without harm a temperature of 40° F.

Drainage

With few exceptions, which are of no interest to the amateur, eacti do not tolerate stagnant moisture, and for this reason eactus soil must be eomposed in such a manner that it provides ample drainage as will be detailed below. For the same reason it is advisable to place a 2-inch layer of gravel or erushed limestone under the pots of eaeti which are sunk in the soil outdoors during summer. The pots themselves should be surrounded with sand. This precaution is, of eourse, most important when the garden soil is clayey and does not drain well by itself.

Danger of Sunburn

When plaeing eacti outdoors in spring, one should remember furthermore that, after having spent the winter indoors, their tissues are quite tender, and that immediate exposure to the full force of the sun is likely to cause sunburn. To avoid injury, it is necessary to accustom the plants gradually to the sun, and for the first week or 10 days the eaeti should be shaded during sunny noon hours, so that they reeeive sun only in the morning and the late afternoon.

Transplanting

Cacti in nature spread their roots for many yards. When confined in pots, they exhaust the soil within two years, and, if not transplanted every two years, their roots commence to die. If in that state a eactus plant is watered freely, it rots. If it is not watered—eacti should not be watered when they are not growing—it gradually shrinks in size and eventually it is likely to topple over, having no roots at all. To save sueh a plant, it has to be transplanted, because it will never make roots again in the same soil. In addition,

Mammillaria elongata (Golden stars)

Rebutia minuscula grafted on a stem of *Cereus guelichi*. It flowers much more freely when grafted than when on its own roots. ⟶

Author photos

it must now be treated as a sick patient.

The fresh soil must be left dry, and the cactus should be placed in a scooped out hollow filled with sand so that it does not touch the soil. To prevent it from moving, it may be held down tightly with two strings crossed over its top which are tied under the bottom of the pot. After three or four days the sand should gradually be moistened a little by allowing a few drops of water to trickle down along the cactus plant. This should be repeated every three or four days. If this is done properly, the cactus will gradually become plump again, and, when its crest shows signs of life by changing color, we are assured that it is producing new roots. The soil then should be drawn over the sand and the plant should gradually be watered more freely.

In this manner it is possible to save a cactus which would otherwise be lost, but the scars caused by such an enforced dormancy remain for its whole life time, and it will never be a perfect specimen. Therefore, if one wants to grow a fine specimen, one should not wait until the plant is in distress but should transplant it every two years, even when a larger pot is not required.

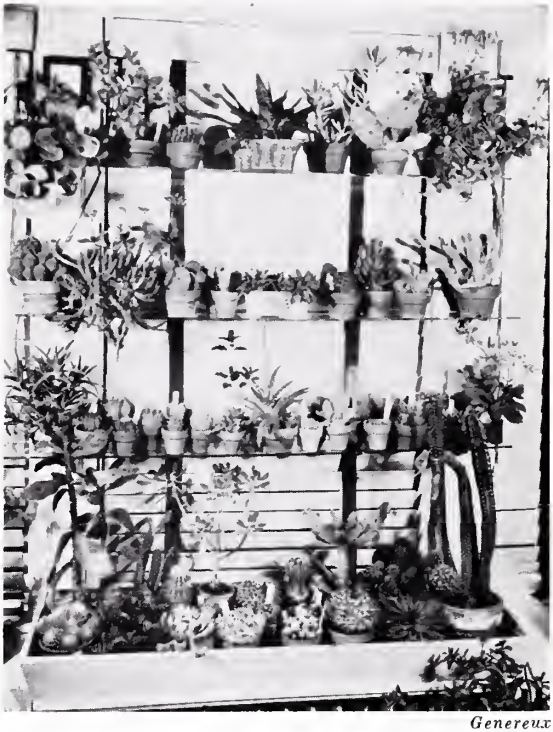
Soil Mixture

The best time to transplant cacti is in early spring, March or April, as the various types and varieties show signs then of returning activity after their winter rest. A suitable soil mixture consists of the following ingredients:

3 parts good garden soil (preferably a clay-loam)
1 part well decayed leafmold
½ part sharp sand (builder's sand)
½ part crushed limestone (¼" size)
½ part crushed brick

To this should be added a small amount of powdered limestone as well as some tobacco dust. Of each of these two ingredients only a "pinch" per pot is needed (as much as can be taken up with the finger tips), or a 2½-inch flower potful to a bushel of soil. The same amount of fritted trace elements may also be added, but no other fertilizer should be incorporated.

Peat moss should not be used. Leafmold, of which only small quantities are needed, may be gathered during summer in the woods. Crushed brick, which has the valuable ability to hold a certain amount of water while allowing surplus water to drain away, may be prepared by



Genereux

Cacti and succulents, with their diversity of form, color and flowering habit, offer a year-arouud source of study.

smashing broken pieces of brick with a hammer into pea-size fragments. The brick dust should be sifted out. Dried and powdered eigarette or pipe tobaceo may be substituted for tobaeeo dust. It serves as a very mild fertilizer and at the same time it aets as an effective preventive against root lice whieh frequently infest the roots of eacti.

Growing eaeti which oceupy their pots for the second year may be fed with a mild solution of a eomplete fertilizer, such as Hyponex, at the rate of one teaspoonful to a gallon of water onee a month.

Christmas and Orchid Cacti

These handsome eacti are not desert dwellers but usually grow on the branches of trees or in cracks of roeks where humus has accumulated. In eonsequence, they require a somewhat richer and looser soil. The amount of leafmold given in the above recipe should be increased to two parts. The crushed limestone should be left out. Powdered limestone and tobaeco dust should be replaeed by dehydrated sheep manure and bone meal in approximately the same amounts. Christmas and orchid eacti should never be exposed to the full sun but, if plaeed outdoors during summer, should be kept in partial shade.

When these two types of eacti are brought indoors in fall, it is advisable to syringe their leaves several times a week. One may also prepare for them large, pebble-filled saucers in which water should be kept, placing the pots on top of the pebbles but not touehing the water. This will serve to humidify the air around the plants whieh will assist them materially in developing their flowers. The ehange from the fairly humid outdoor air to the dry air of a heated room frequently causes dropping of the flower buds, if no sueh precautions are taken. The rest period is much less pronouneed with these South Ameriean eaeti.

Propagation

Offsets, or shoots formed at the base, or side branches of a eaetus, may be used as euttings after their seasonal growth is eompleted. They are then severed with a sharp knife from the parent plant at their very bottom. With some eaeti, "pups" even break off easily when the plants are at rest. Sueh euttings are then treated in a manner very similar to that deseribed for a eaetus which has lost its roots. Cut ends are dipped in powdered ehareoal to prevent rotting, and the euttings are inserted in dry sand to whieh a small amount of soil may be added. For the first two or three weeks the sand is kept dry, after which it is moderately moistened from time to time. When the euttings show signs of growth at their tips, they are watered more freely until they are ready for potting. A foot-long pieee from the top of a tall column eaetus ean be treated in the same manner, though the eut lower end must first be allowed to dry for three or four weeks.

BEGONIAS

An introduction to the best types and varieties to grow indoors

Bernice Brilmayer

THE Begonia Family is unbelievably diverse. Many hundreds of varieties are available today which range in size from 3-inch round balls of leaves and blooms to 6-foot hedges. There are begonias that naturally creep, climb, dangle, or perch on trees. Some have leaves as small as your little fingernail, on others they measure 3 feet in length and breadth. Foliage may be ruffled, pointed, serrated, deeply cut, spiralled, or neatly round, in all kinds of patterns and textures, and of all colors including deep blue. Flowers may be of any color except blue, single or double, hanging in heavy clusters, or nodding in airy showers atop tall stems.

Because of this wide variety, it is difficult to sort begonias into any system of neat, clear-cut classification. The closest we can come is to group them according to their root systems—fibrous-rooted, rhizomatous, and tuberous-rooted—and subdivide these classes as the plant's characteristic appearance and habit seem to dictate. In most groups there are begonias small enough to grow in dish gardens or on crowded windowsills, or large enough for a bay window, sun porch, or greenhouse.

Among the many begonias with branching, fibrous roots, the best-known and most widely grown type is called **semperflorens** for its year-'round flowering habit, or "wax begonia" for the glossy polish on the numerous crisp, nearly round leaves. Single-flowered varieties have long been favorites and are now widely grown in summer window boxes or as bedding plants in semi-sunny gardens. The newer semi-double (crested or thimble-type) and double (rosebud or camellia-flowered) hybrids are more delicate but infinitely more appealing. Among the several dozen named varieties, 'Pink Camellia' is rather robust, with large mahogany-colored leaves and rosy flowers as double and full as hoopskirts; 'Snowdrop' is a 3-inch dwarf with bronzy leaves and double white flowers; the green-leaved 'Genevas' come in a choice of pink, white or red double flowers.

Another fibrous-rooted group is called **cane-stemmed** for its bamboo-like stems with distantly spaced, swollen nodes, or "angel wing begonia" for its wing-shaped leaves. These, too, are floriferous and begin while quite small to drip heavy clusters of large flowers from the tips of their arching branches. Among the favorites are 'Corallina de Lucerna,' with large white-spotted leaves and coral flowers, growing quite tall in time, and 'President Carnot,' with satiny leaves pointed on the edge and deep or pale pink flowers. A newer hybrid, highly recommended for indoor growing, is 'Orange Rubra.' Its angel-wing leaves are glossy green, sometimes silver-spotted; its branches of salmon-orange flowers may be larger and heavier than the plant; its size is moderate.

The **hirsute**, or "hairy-leaved begonias," make up another fibrous-rooted group. They are partly or completely covered with a coat of soft-silky or whiskery hair, even on the outside of the flowers. A familiar example is *B. scharffi* (*haageana*) which grows large and fully branched, the pointed leaves upholstered in shimmering olive velvet on top, wine-red beneath. Its white flowers sport bright pink beards. 'Mrs. Fred D. Scripps' is a robust, fairly new hybrid with large, fuzz-covered leaves divided, almost palm-like, to the stem end. 'San Miguel' is another new one, the

Author

Calla-lily begonia (*semperflorens*), 'Maine Variety'. One of the sturdiest for indoor growing. Deep green leaves heavily variegated with white; new leaves white, resembling calla. Pink flowers.

cupped leaves more round, white-felted, sometimes growing so large they need support.

Also fibrous-rooted but impossible to categorize are a number of miscellaneous, odd, or rare begonias that make excellent house plants. For hanging baskets, there are lush trailers like 'Shippy's Garland' with crisp, crinkled leaves on freely branching stems and myriads of cherry-red flowers. There's upright and branching 'Dancing Girl,' with no two leaves exactly alike in size, shape, contour, or sprinkling of silver. And there are oddities like *B. venosa*, with thick, cupped leaves covered with white felt and persisting stipules like brown tissue paper.

The common characteristic of **rhizomatous** begonias is their thick, scarred rootstock—a swollen stem that creeps over, not under, the soil and sometimes ascends. On one side of this rhizome are eyes from which leaf and flower stems grow up; from the other side, roots grow down into the soil.

Genereux

Begonia 'Bunchi' has bright green, crinkled leaves which inspired its popular name, "lettuce-leaf begonia."

This group includes many sturdy, old-time favorites. There is the "beefsteak begonia," 'Erythrophylla,' with flat, round leathery leaves gleaming green on top, blood red underneath. Its pink flowers appear at the top of tall stems, high above the foliage, in late winter or early spring. One of its variants, 'Bunchi,' is popularly called "lettuce-leaf begonia" because the fresh green leaves are crisply fluted and frilled on the edge. There is 'Ricinifolia,' its large castor-bean-like leaves facing front from the upright rhizome; and *B. heracleifolia sunderbruchi*, with sharply cut, star-shaped leaves in deep green accented with streaks and splotches of a lighter shade.

Among the more recently discovered or introduced rhizomatous begonias, *B. kenworthyi* has been welcomed by hybridizers and is now the parent of some fascinating offspring. Its rhizome is semi-erect, very thick and contorted, almost bonsai-like; the leaves are heavy, shaped and veined like a large ivy, and colored dull gray-green. *B. masoniana* has created considerable excitement since its introduction several years ago, and probably will always be better known by its common name, 'Iron Cross.' The wide, heart-shaped leaves are finely nubby, basically gold-green, and marked with a distinc

mahogany replica of the German cross in the center.

Mostly of rhizomatous habit, but definitely in a class by themselves, are the rex begonias grown for their gorgeously patterned and brilliantly colored foliage. The cup-shaped porcelain-like flowers are also exotic, but are overshadowed by and often hidden beneath the leaves. Here, too, there is a wide variety in size, shape, and decorative effect.

There are dainty miniature rexes, like 'Baby Rainbow,' with small leaves zoned in jewel tones of emerald, amethyst, ruby, silver. 'Dew Drop' is a dwarf, its raspberry-colored leaves completely overlaid with mother-of-pearl. Among the larger varieties, 'Silver Sweet' is good for beginners, grows vigorously into an upright and well-branched bush. 'Merry Christmas,' more correctly called 'Ruhrtal,' is one of the easiest and most brilliant, its leaves of holiday red and green accented with silver. The crisp, firm leaves of 'Can-Can' are like iridescent lilac taffeta. The number of named rex begonias available today must number up in the hundreds, and many more are sold without names, by color alone.

Relatively few begonias of tuberous or semi-tuberous habit are grown as house plants. Most of these are African species or their hybrids, with small, maple-shaped leaves and modest flowers. During winter they may rest or drop their leaves and go completely dormant. The majority of the tuberous-rooted types are either winter-flowering hybrids, florists' gift plants, or summer-flowering in hanging baskets or in semi-sunny garden borders. Their tubers are dormant in winter.

In such a large group of plants with such widely varying origins and characteristics, there is bound to be variation in culture. The chart gives, first, a thumbnail sketch of average cultural conditions for all types of begonias. This is followed by a break-down of the generalized classes, with ways in which average culture can be adapted to suit each class. A brief note of methods of propagation is also included.

'Maphil' or 'Cleopatra' (rhizomatous). Very popular pot and basket hybrid with star-shaped leaves variegated with chartreuse and gold. Pink flowers on tall stems; spring flowering.

'Thurstoni' (upright, fibrous-rooted). Barbershop favorite with metallic bronzy-green leaves, very waxy appearing, scarlet beneath. Flowers with silky red hairs.

Roche

Guide to the Basic Cultural Requirements of Classes of Begonias

Types of Begonias	Temperature	Humidity	Sunlight
Average for all types:	60-70° Night 65-75° Day	50%	Full in winter; shade near noon in midsummer; more shade in hot climates
Fibrous-rooted: **Semperflorens "Wax Begonias"**	Average or slightly cooler	Average or slightly less	Average
Cane-stemmed "Angel Wing Begonias"	Average or slightly cooler	Average or slightly less	Average
Hirsute "Hairy-leaved Begonias"	Average or cooler	Average or less	Average for bloom; less for foliage types
Rhizomatous Begonias	Average for most; higher for some tender types	Average for most; more for tender types	Average for bloom; less for foliage types
Rex Begonias	Slightly higher	Slightly higher	Good light, but little sun
Tuberous-rooted: **African species "Maple-leaf Begonias"**	Slightly higher	Slightly higher	Average or slightly less
Hiemalis, Cheimantha "Christmas Begonias" Florist gift plants	Cooler	Higher	Average
Tuberhybrida Summer-flowering, tubers dormant in winter; basket and upright garden types	Not usually grown as indoor pot plants; require different culture; not within the scope of this article.		

Guide to the Basic Cultural Requirements of Classes of Begonias

Soil Mixture	Watering	Propagation
⅓ loam ⅓ humus ⅓ sand or substitute Slightly acid	Keep soil moist but not soggy; water before it is completely dry	
Slightly heavier; add more loam Do not overpot	Grow drier. Let soil dry thoroughly between waterings	Stem cuttings with one branch, if possible Seeds—single-flowered types
Average	Grow drier. Let soil dry thoroughly. Lower leaves drop if too moist	Stem cuttings Seeds
Slightly heavier; add more loam	Grow drier. Let soil dry thoroughly. Too moist causes rot	Stem cuttings Seeds
Lighter, more porous; add more humus Shallow pots best	Average	Leaf-stem cuttings Rhizome cuttings Seeds
Lighter; double proportion of humus	Average; drier when dormant or resting in winter	Leaf-stem or leaf-wedge cuttings Rhizome cuttings Seeds produce new varieties
Lighter; add more humus	Average; drier in winter dormancy	Stem cuttings Seeds
Average	Average	Leaf cuttings Stem cuttings

Drawings by Eva Melady

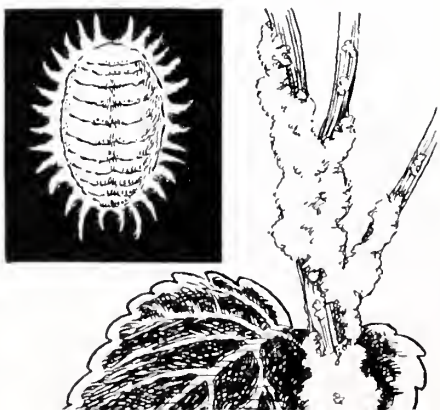
Aphid

should be used every few days until control is complete. Use cautiously as the manufacturer advises. Do not use malathion on anthurium, crassula, ferns, and kalanchoe. For these, spray with nicotine sulfate (Black Leaf 40) and soap according to package directions. I prefer to fill a basin with the solution and dip the entire plant in this, being careful to keep soil and pot intact by wrapping them with aluminum foil.

Mealy Bug

Small cottony fluffs appearing along leaf veins or at leaf axils where stems join the main branch show that mealy bug has moved in. An additional symptom is a sticky secretion which makes shiny patches on the leaves. Mealy bugs can be treated in the same way as aphids or by touching each miniature "cotton boll" (an egg sac) with a toothpick which has been tipped with a piece of absorbent cotton and dipped in rubbing alcohol or toilet water. The same treatment routs the adult mealy bugs, which are tannish-white or grayish-white and of oval shape with numerous fringe-like filaments radiating in all directions. After a week the treatment should be repeated and this may be necessary three or four times before all disappear. Care should be taken to touch only the insect with alcohol, not the leaves.

Mealy bug



Red Spider

Red Spider

Red spider is hard to see but its work is a distinct giveaway. Leaves take on a speckled gray-green or yellowish appearance. Sharp eyes will note a tiny web on the undersides or in the axils of leaves and a magnifying glass will disclose the mites crawling within their silken "parlors." Many can be washed down the drain with a forceful stream of water, made by placing a thumb over part of the faucet. Also use a malathion spray or an aerosol house plant (not household) bomb.

In using any spray bomb, be sure to hold it at least 18 inches from the plant.

Scale

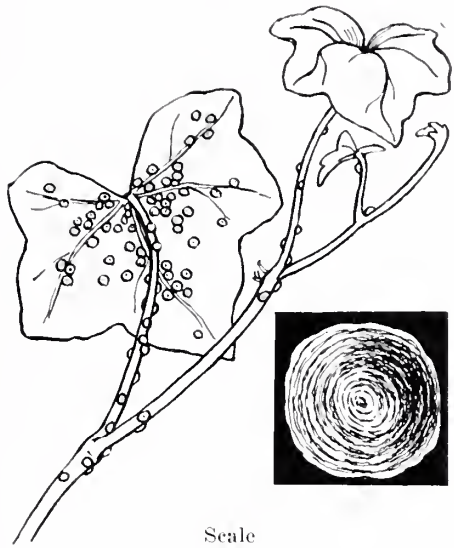
Malathion offers a good control; use as recommended for aphids. The strong-stream-of-water routine will also discourage scale—the insect which lives under an armor like a flat turtle shell but has no means of locomotion. Scale, however, is not always oval like a turtleback, but may be hemispherical, pear-shaped or even threadlike. Only when young can these insects move about. Thereafter they are glued to the spot until you discover and do away with them, removing them one by one with a fingernail, or using the forceful-stream method or an insecticide such as malathion or an aerosol bomb. For tender plants that might be damaged by rough treatment, the insecticide spray is the best. Quite often, indoor gardeners mistake the spore cases of fern for some species of scale. However, fern spore cases are lined up in neat ranks, while scale, often more haphazard, will be found on stems as well as on the undersides of leaves.

White Fly

White flies are hardest to exterminate. Sometimes they are not noticed until a slight jar or bump makes them fly about. The young do not fly but are small pale cream specks on the undersurfaces of leaves. They also secrete a sticky substance. An aerosol bomb, DDT, or malathion will kill the adults but unfortunately the young are immune. For this reason, persistent spraying is necessary and any infested plant should certainly be isolated at once for it is an easy matter for winged insects to fly from one plant to another.

Fungus Diseases

Among fungus diseases, leafspot is the most common. It can be controlled by dusting with sulphur or phaltan, covering both under and upper leaf surfaces with a fine dust film. Here again, cleanliness and sanitation can help in preventing leaf spot from appearing.



Scale

Leaf tips that turn brown are usually not caused by disease but are the result of too dry an atmosphere—a common condition in steam-heated homes. African violet leaf spot may be the result of accidental water drops cooler than room temperature or from wet leaves placed in the sun. Crown rot is invited by overwatering. When fungus diseases make inroads, a protective fungicide should be sprayed on all plants as a protective measure, even though they are apparently healthy. Fortunately, fungus diseases rarely appear on house plants that receive good care and proper sanitation. So it is the insect attack we must guard against with an immaculate grooming program, an alert eye, and an ever-ready spray gun.

White fly

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WINTER
1962-63

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in
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VOL. 18 NO. 4

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PLANTS & GARDENS

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Louis Buhle

BONSAI PINE that was stolen from the Brooklyn Botanic Garden in early September, 1962. It is a Japanese white pine (*Pinus parviflora*), a gift to the Botanic Garden in 1957—for all to enjoy. It is said that there is honor even among thieves. If so, this magnificent 40-year-old specimen will find its way back to the Garden—perhaps as mysteriously as it disappeared (see article on page 4, by George F. Hull).

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The Year-end, 1962-63

In the pages that follow readers will find our Editorial Committee's eighteenth annual selection of articles that have appeared during the year in other gardening and horticultural magazines. Most of the subject matter is not new, but the articles are of lasting interest and significance. We present them with pride and with the full cooperation of the authors, editors and publishers of the originals. Special honors go to the authors whose material has been selected.

There has been considerable interest this past autumn and winter in Miss Rachel Carson's book SILENT SPRING. It is unquestionably a book of vital interest to every living American because it concerns the use of poisonous sprays for the control of plant pests of agricultural crops, fruit orchards, and even the home garden. The nub of Miss Carson's argument is that this "chemical contamination of the earth" further upsets the balance of nature, destroys birds and other wild life, and threatens the very life of man himself. The book has been widely reviewed, not always favorably—because of its often exaggerated presentation. The latter point has brought it wide attention, and properly so; it was clearly one of the author's objectives to stir people to think. But who wants to eat a wormy, unsprayed apple? Or let bugs destroy their favorite blossoms? There must be a middle ground that will make pest control acceptable to all, and at the same time avoid the obvious danger.

Miss Carson's basic premise is that the knowledge and skills of man have enabled him to make many new and stable molecules that do not occur in nature. It is the stability of these new chemical substances, together with their toxicity, which enables man to cope with the insect pests of the world. It is also the stability and toxicity of these substances which make them dangerous to humans and other animals. DDT is one of the serious offenders, but research has already pointed the way to safer compounds.

It is not possible to resolve here the problem Miss Carson has taken several hundred pages to present, but I would like to call attention to a most thoughtful review in the January 1963 issue of NATURAL HISTORY Magazine (pages 3, 4 and 5) by William Vogt. Dr. Vogt's review also mentions and strongly recommends OUR SYNTHETIC ENVIRONMENT, by Lewis Herber, published by Alfred A. Knopf (New York) three months before the Carson book appeared.

What about the use of pesticides on ornamental plants? Let Dr. Cynthia Westcott, plant pest and and disease specialist and well-known scientific writer, answer: "Anyone who can read and who is willing to apply a little common sense can use chemical pesticides safely in home gardens. I make this statement unequivocably as a professional plant doctor. For 25 years I personally sprayed other people's gardens—about 50 a week during the growing season, without harm to myself, my clients, or their children, pets, birds or plants . . . however . . . I find that gardeners are apt to forget that common sense is a necessary concomitance of handling any chemical no matter how innocuous." Sprays can easily be timed to avoid injury to bees, birds and other wild life. And we know of no manufacturer who fails to state that dangerous spray materials should be used with caution and only according to directions given.

So, after reading the directions, spray on! But with reasonable caution, and only when needed. That is what we plan to do here at the Botanic Garden. It is what we have done in the past. And to the best of our knowledge, no one has ever been harmed.

Sincerely yours,

George S. Avery, Jr.

Director

BONSAI KIDNAPING MYSTERY UNIQUE IN ANNALS OF CRIME

Theft of tree from Brooklyn Botanic Garden represents big loss to viewers

George F. Hull

WAS IT THEFT or kidnaping? That is a question which might be asked about one of the strangest cases in the annals of modern crime, when on the fourth of September last autumn it was reported to the New York police that an outstanding bonsai, a potted tree trained by the Japanese to represent a giant tree in miniature, had disappeared from the Brooklyn Botanic Garden.

As far as the law is concerned, removing the tree valued at $2,000 from the garden was grand larceny, without involvement of the Lindberg Law. But to those who valued the stolen item as a living plant as well as an art object, the case had the overtones of a kidnaping. For instance, if a great hue and cry were raised over the disappearance, would the thieves kill the plant to destroy the evidence? Did they know how to give it the daily care it needed? Would they mutilate it in order to effect a disguise?

How the tree was stolen remains a mystery. Over the long Labor Day weekend many thousands visited the Botanic Garden, a substantial per cent viewing the display of bonsai. This particular tree was with many others in an outdoor growing area where they are kept most of the time.

"Someone in the know stole the tree," according to Dr. George S. Avery, Jr., Director of the Garden, because of some 200 in this part of the garden this was one of "three or four of the finest" in the collection.

The abducted victim was a Japanese white pine about two feet tall, trained to three trunks to suggest a gnarled grove of pines on a distant horizon, the tree roots exposed to some extent to suggest venerable specimens in a windblown group. With its shallow oval pot of soil, the plant weighed between 40 and 50 pounds.

Police theorized that it was probably stolen at night, and to get an object of this size and weight over the high surrounding fence, it was surmised that the thief needed one or two accomplices.

The authorities kept the theft a secret while garden officials made a canvass of some 200 persons known to have collections or to be particularly interested in bonsai. It was hoped that the thieves would sell the plant, perhaps at a fraction of its worth, and that the buyer would come forward to see that the tree was returned to the Botanic Garden.

Originally this specimen bonsai had been bought by Mr. and Mrs. Howard Phipps, of Westbury, Long Island, from a nursery in Tokyo. Several donors have presented bonsai to the Brooklyn Botanic Garden, some as far back as 1925, and the Phipps wanted to add this one to the collection. Plant quarantine laws are strictly enforced to prevent entry of insects and disease, but in this case a spe-

Reprinted from *The Chattanooga Times*, January 20, 1963

cial dispensation was ordered for the Brooklyn institution for the plant to be brought into the country with its roots in soil. Post-entry quarantine was required, however.

By coincidence, I saw this plant and a number of others in 1957 where they were kept for a year at the U.S.D.A. plant introduction station at Glenn Dale, Maryland. At the time I saw them they were in an enclosure of double-mesh wire, on tables whose legs were placed in bowls of oil to prevent insects from leaving the plants. There was also an over-all structure that was screened and it too was surrounded by another oil moat. Then in November, 1961, my wife and I saw (and photographed) it, this time on display at the Brooklyn Botanic Garden.

When the local investigation proved fruitless, Dr. Avery announced the loss to the press. The New York Times printed a picture of the tree and a story of the abduction. The Associated Press carried the story on its wires throughout the nation.

At the same time, the Brooklyn Botanic Garden printed what might be considered a "wanted" notice, addressing it to all association members and the more than 2,000 who have taken courses in bonsai at the Brooklyn institution. The notice included a photograph of the tree, and a reproduction of the article in the New York Times of Nov. 23, 1962. With it went a special appeal from Dr. Avery:

"To the approximately two thousand people who have taken bonsai courses at the Botanic Garden since they were first offered in 1955: You have come from as far west as Illinois, north to Canada, eastward to Boston and as far south as Chattanooga, Tenn. You may be offered bonsai by dealers, and you will have seen —and be seeing—bonsai exhibits and collections of others. We turn to you in particular to give us your utmost aid in securing the return of the living tree in good condition. Thievery should have no place in the world of bonsai! Please let us hear from you about any clue or clues that you might think may prove helpful."

Last week Dr. Avery told me that so far no worthwhile clue has turned up. But, he said, "If it is possible to see a good side to such an event it might be the wide-spread sympathetic interest that has been shown throughout the country. The Associated Press story was carried widely and we know from the many clippings we have received that it was printed on the front pages of newspapers in all sections. Where previously not too many have even heard of bonsai, now perhaps it has been brought to the attention of 25 million."

Local concern is also at a high peak, Dr. Avery said, and proved the point by an incident that happened recently. A member of the garden staff, he said, was recently given a cull plant which was of little value, although it was an interesting species. In order to take the plant home, the staff member enlisted the help of a friend who had a car that was parked next to the garden but at some distance from the exit. The staff member took the plant to a point next to his friend's car, handed it over the fence. Someone in an apartment across the street saw this activity, and immediately reported it to the police. A radio patrol car rushed to the scene, and both men were placed under arrest, until their explanation was verified.

As with kidnaping cases, crackpot and crank calls and letters have come to the principals. And well-wishers offer advice. Just last week Dr. Avery received a letter suggesting how to conduct the search. "Don't look in the usual places," it admonished. "Look in the hospitals."

The staff at the Brooklyn Botanic Garden is still mystified, and still hoping. "It is almost incomprehensible that anyone in his right mind would take a specimen from the collections that are here for public enjoyment," Dr. Avery commented. And then he told me, "I still hope that some time this spring we will go out in the garden and find that our lost specimen has been brought back, is again in its place on the benches with the other plants."

HOW TO SAVE TREES WHEN PAVING OR CHANGING THE GRADE

Richard K. Webel

THERE are times when the shape of the land must be changed to accommodate a house, terrace, or drive, or to alter surface drainage. And, all too often, there are trees "in the way."

When this seems to be the case, it is time to study the plan again. Quite often the plan can be adjusted to fit the lay of the land better, and some trees can be spared. It is worth a good bit of time and effort to save a good specimen. Nothing we can design or build in a garden is so useful and beautiful as a good, healthy tree.

Zue Martin

WHEN THE GRADE IS LOWERED: Mark a circle half way between the trunk and the outer edge of the branches, and do not disturb the roots inside this line. This will preserve the essential part of the root system, which ordinarily extends to the perimeter of the foliage. Outside the halfway circle, dig a trench to the level of the grade to be established. Build a retaining wall around the center core from the new level up to the original.

The grade can be changed considerably around a tree and it will still survive—if the proper precautions are taken. You can pave over the root area—if you use the right kind of paving. Almost any tree, in fact, *can* be saved. You can move the earth however you wish without harm to the tree if the following conditions are met: Don't disturb the roots nearest the trunk. Maintain the supply of air, water, and plant food in the root area. Keep excessive moisture away from the trunk. This is essentially true of all trees, but, of course, some are more amenable to change than others. More about this later.

To Lower the Grade

When you must cut to lower the grade around the existing tree, there's a limit to how close you can safely come to the trunk. Root spread varies with the tree, but, in general, the outer roots extend to the perimeter of the foliage. Do not disturb the roots for at least half the distance from the trunk to the outer edge of the foliage line.

The first step in lowering the grade is to make a clean vertical trench with a shovel all around the tree to the depth you intend to lower the ground. Use a limb lopper or saw to make clean cuts on roots too large to cut cleanly with a shovel. A bulldozer should not work this close to a tree you wish to save. The blade can catch a large root, move the tree, and rip more feeder roots than it can spare.

As soon as the ground is cut away to

Condensed from *House Beautiful*, May 1962

Maynard L. Parker

Where there is a considerable change of grade, the appearance of a deep cut around a tree can be minimized by paving a wide area, as shown here, then dropping to a still lower level by steps and a low wall. Design by Thomas Church and Associates. (If the grade is raised, a similar landscape effect can be achieved. A seat can hide a porous rock fill around the trunk.)

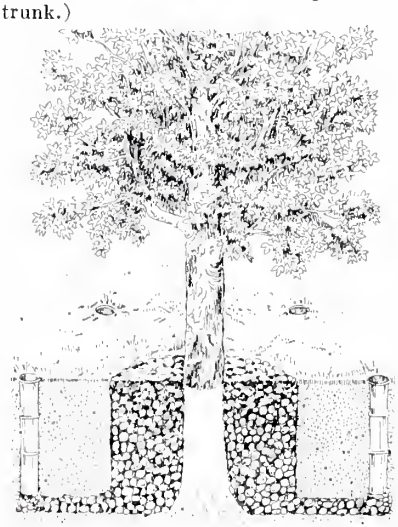
the depth you want, build a retaining wall to hold as much of the soil in place as possible. If this cannot at first be the permanent retainer, put in temporary supports to keep the soil from falling away from the roots. Backfill and firm the soil down between the wall and edge of cut. The permanent retainer can often be built around the temporary one to avoid further disturbance of the roots.

To Raise the Grade

When you raise the grade around a tree, the solution is more complex, but no less effective. The problem is to keep soil away from the trunk and to provide a means for the roots to get air and water.

Before you move any soil, fertilize the tree in the usual way. The more vigorous a tree is, the less it will be affected by any possible mishandling.

Cover the root area, from the trunk to the outer perimeter of the foliage, with an 8- to 12-inch layer of large crushed rock. Then add a thin layer of fine



Zue Martin

WHEN THE GRADE IS LOWERED: Cover the entire root area with about a foot of coarse rock, then add a thin layer of fine gravel. Surround the trunk at a distance several times its diameter with a cylinder (which can be of coarse-mesh hardware cloth), and fill it with crushed rock or other porous material up to the level of the new grade. Outside the core of crushed rock, fill to the required grade with good porous soil.

Gottscho-Schleisner

This raised brick terrace is about three feet above the original grade. To save the tree, a planting well was made. To avoid the dark hole in the ground, and to keep the opening from becoming a catch-all, the well was filled with coarse gravel to the level of the terrace. The ground-cover plants are in pots. Landscape architects, Innocenti and Webel.

crushed rock to keep the soil from working down below the surface. This porous layer of rock will allow air and moisture to circulate in the established relationship to the root area. It is a reasonably effective means of aerating the roots and the covered portion of the trunk.

No soil should touch the trunk above the original ground level. There are two good ways to prevent this. One is to build a retaining wall around the trunk of the tree far enough from the tree to allow room for future growth, and to look good in relation to the tree. The other method is to lay a loose collar of rock around the trunk to keep soil away. If you make a retaining wall to hold back the soil, the well around the tree can be filled with rock or covered with a grating. If the well is large, use coke or lava or a lightweight material such as Featherock. Too much weight on the roots can damage them. An open tree well tends to collect debris and, if too deep, can be a danger to small children.

When the trunk is protected thoroughly, you can fill over the gravel to the height you want with porous soil. For a large tree it is a good idea to sink a circle of 6-inch tile pipes around the perimeter of the foliage as shown in the sketch. These openings will let in air and allow for watering. They can also be used for applying fertilizer.

When You Pave Around a Tree

Some kinds of paving over the roots will actually benefit the tree. Others will kill it. Brick or flagstone, concrete rounds or squares, or any other material laid on a bed of gravel and sand with open space to let air and water through, will help a tree. Such paving works as a mulch to keep weeds down and help hold moisture in the root area by reducing evaporation.

Paving laid free on a bed of gravel and sand is flexible and will move with the expansion of the roots. This slight undulation is not unattractive to the eye. To the tree it can mean the difference between life and death. With this kind of material you can pave to within two feet of the trunk. All that's needed is space for the trunk to grow in diameter. It's a good idea to feed the tree thoroughly before you pave around it.

Do not pave solidly over a root area that has been open to the weather. If more than half the root area of an established tree is suddenly denied air and water, the chances are it will die.

If necessary for a drive, walkway, or parking space, you can pave solidly over part of the root system without losing the tree, if you don't cover more than half the root area and do the job properly. If the ground is uneven and must be leveled before paving, level the area by filling, not by cutting. It is much safer to fill than to cut into the ground and risk damaging the roots. Do not use soil for this fill over the root area. It does not admit enough air under the paving to supply the roots. Use porous material, such as sand or gravel.

It is always a good idea to keep any

paving back a few feet from the trunk of the tree. This will leave space for a planting bed of ground cover or low shrubs around it. It looks more natural to have the tree trunk rising out of a lower planting than to have it coming right up out of a hole in the paving. A plant bed also simplifies watering and feeding.

Keep in mind that the planting in the bed will compete with some of the tree roots for food and water. Make sure there is enough for all needs. Keep the growth from pushing right up against the tree trunk. Insects or fungi can girdle and kill a tree unless there's good ventilation at the trunk's base.

A Few Exceptions

Some trees can survive a foot or so of new soil over the root area. This is true of all trees with pronounced sucker growth, such as apples, willows, and elms. They develop new roots in the new soil and do very well. To encourage new root growth, use sandy fill so air and water will penetrate easily.

There is always danger of rot when soil is pushed against the trunk of a tree, even a tree that suckers freely. Make a high wide collar of crushed rock around the trunk to keep the soil away and let air in.

Maynard L. Parker

Ample ground is left around the tree at the original level, and the area is filled with an underplanting. A frame of redwood or cypress can be used to hold the soil in place; a paved terrace here drops off on two sides. Landscape architect and owner, Jack Stafford.

Lifting and Replanting

As a last resort, if you can't save a tree where it is, consider lifting it, doing the necessary grading, and replanting it. This, of course, is easiest to do when you lower the grade. Dig around the sides, and cut all the roots cleanly in a circle about half the perimeter of the foliage. The earth can then be moved away by bulldozer. The tree will now be high and dry on a small pedestal of soil. Dig in at the bottom all around until you can get burlap around the ball of soil. Wrap it firmly in burlap and put the tree aside until it can be replanted. Keep the root ball very moist while it is out of the ground.

The easiest trees to move are the surface-rooted ones such as maple, elm, linden, dogwood, apple, flowering trees, and all conifers. A good tree man, properly equipped, can easily handle these trees with trunks of five to six inches across.

Tap-rooted trees, such as nut trees and most of the oaks, are almost impossible to dig up and transplant successfully, without prior, planned root-pruning.

As you look at the work it may require to save a tree when you change the grade, you might be tempted to say, "It's only one tree. We can certainly spare that or replace it." The truth is there is seldom a tree that can be cut without its being missed, and a new tree planted to replace a mature one will never be the same; not, at least, in your lifetime.

Flowering is induced in *Vriesia geniculata* a few weeks after a measured amount of a component of rocket fuel is supplied to the leaves. Plant at left received no treatment.

NEW DISCOVERIES IN PLANT GROWTH

Size and flowering of many plants can be controlled with chemical treatments and artificial lighting

Henry M. Cathey

All illustrations by courtesy of the American Horticultural Society

WHEN we know enough about the chemistry of the plant, we will add a particular chemical, and so many days or weeks later observe a desired change in the pattern of growth. A vriesia, which is a bromeliad collected from the tropics, is an example of this. It will hold water and is often used as a vase plant. When one empties the water out and fills it with a certain pale amber solution, the plant is in flower six months later. This suggests the future of growth control.

The chemical used on the bromeliad is B-hydroxyethyl hydrazine (4). [See references concluding this paper.] In Hawaii it is used to flower pineapples, another kind of bromeliad, year-round. It is also used as an additive in mink food to prevent cancer and is added to liquid oxygen to make rocket fuel. The first action of the chemical on plants is to slow up growth, then flowering results.

Unfortunately this chemical is active on only a few kinds of plants but others are doing the same thing, retarding growth and in some cases promoting flowering. Such chemicals as a class are called growth-retardants. They are useful in production and maintenance of plants of smaller size than those typical of the species or the cultivar. They also make it possible to use some species not now

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available for pot use and allow all plants to be fertilized and watered as frequently as necessary. [The chemicals make them more or less insensitive to certain excesses.]

The leaves of all plants treated with growth-retarding chemicals are much darker green than those of untreated plants. This color is related more to the action of the growth regulator than to mineral nutrition.

The Chemicals and Their Effects

Three chemicals have been extensively tested on many kinds of plants (2). These are Amo-1618 (4-hydroxy-5-isopropyl-2-methylphenyl trimethyl ammonium chloride, 1-piperidine carboxylate), phosfon (tributyl,2,4-dichlorobenzyl phosphonium chloride), and CCC (2-chloroethyltrimethyl ammonium chloride). The growth of most plants may be controlled by the proper selection of one of these chemicals. None of the three is active on all plants. Few plants respond to applications of Amo-1618. The dosages for phosfon were 0.16 to 4 gm. of the technical material and for CCC, 4 to 20 gm. per cubic foot of potting soil. The list* which follows shows the growth-retarding activity of two chemicals on potentially useful plants.

Common Name	Response to Applications of Phosfon	CCC (Cycocel)
Apple	Inactive	Active
Azalea	Active	Active
Camellia	Active	Active
Chrysanthemum	Active	Active
Dogwood	Active	Active
Euonymus	Active	Active
Fatshedera	Stimulates	Active
Holly	Active	Active
Hydrangea	Inactive	Active
Lily, Easter	Active	Active
Maple, Red	Active	Active
Oak, Red	Active	Active
Pear	Inactive	Active
Petunia	Active	Inactive
Philodendron	Inactive	Inactive
Poinsettia	Stunts	Active
Privet	Inactive	Active
Rhododendron	Active	Active
Sycamore	Stimulates	Active

The Plants Tested

The basic concept of using growth-retarding chemicals is being tried extensively on many kinds of plants. Most foliage plants, such as *Dieffenbachia, Peperomia* and *Philodendron,* grow without apparent responses to applications of phosfon and CCC. High dosages (100 to 500 times the dosages used on chrysanthemums) frequently stunt growth and result in a reduction of leaf size, drying of the margins of the leaves, and the development of few or no lateral shoots. Plants of chrysanthemums, coleus, and *Schefflera actinophylla* respond to applications of both chemicals by continuing to form leaves at the same rate as untreated plants but the distance between leaves decreases with increasing dosages.

Woody plants as a group are not particularly adapted to the immediate utilization of growth-retarding chemicals because they grow for only a few weeks during the year and the root system tends to be extensive. Preliminary testing is being conducted with plants growing in clay pots on long days. Plants of several holly species, euonymus, privet (*Ligustrum*), rhododendron, and oak respond to applications of phosfon and CCC. Plants which grow in flushes such as oak and holly respond only to much higher dosages than does chrysanthemum. The time from one period of growth (flush) to another is delayed slightly and the number of nodes per flush is smaller than on untreated plants.

Plants from many different families such as chrysanthemum, rhododendron, hydrangea, and mimosa, respond to applications of CCC at dosages of 10 grams [approximately one-third ounce] per cubic foot of composted soil. In contrast, the optimum concentration for growth retardation by phosfon varies from 0.16

*Mention of commercial products herein does not constitute their endorsement. Phosfon is registered for use on chrysanthemums by commercial florists. CCC is still in the experimental stage of development and is not generally available. Results reported herein for phosfon and CCC are given as research results only and do not constitute official clearance or recommended use.

EFFECTS OF PHOSFON AND CYCOCEL: The petunia variety 'Ballerina' at left remained very dwarf when 1/7 ounce of Phosfon was added to a cubic foot of potting soil. Center plant, no treatment. Plant at right, with approximately 2/3 ounce of Cycocel per cubic foot of potting soil, shows slightly retarded growth.

centimeter per cubic foot of potting soil for chrysanthemum to 4 grams per cubic foot for rhododendron.

The results from applications of growth retardants to monocots have generally been disappointing. Although wheat responds markedly to CCC, the other grains have responded only at fairly high dosages or not at all (7). Tillering [sending up new shoots from the base] was promoted on treated plants and occurred earlier than on untreated plants. The tendency of the plants to lodge [to become beaten down] was also reduced.

Factors in Testing

These points are vital in the use of growth-retarding chemicals:

(1) Soil plant regulator mixtures of varying dosages are prepared by dissolving the required amount of chemical in water, pouring it on a known volume of composted soil, and mixing thoroughly to distribute the chemical throughout.

(2) Plants already established in soil may be drenched with the chemical at rates similar to those used in the soil amendment procedure. The latter procedure is preferred for treating at a specific stage of growth.

(3) Plants sprayed with aqueous solutions of phosfon develop yellow spots on the leaves. At high dosages, the veins are cleared of chlorophyll and the leaves develop marginal browning which persists throughout the life of the plant. Other plants sprayed with aqueous solutions of CCC develop yellow tips. Eventually the leaves regain their green color. The margin of safety between retardation without injury and with injury from growth retardants applied as foliar sprays is very small and should not be considered for general use as a method of applying them at the present time.

(4) Amo-1618 and phosfon persist in the soil for more than one crop of plants whereas CCC did not persist for the growth of one crop. Amo-1618 was slightly more active in summer, phosfon much more active in summer, and CCC much less active in summer than in winter in retarding growth of plants.

Differences in Plant Reactions

Not all varieties of a given plant species are equally sensitive to growth-retarding substances (3).

All plants treated with growth retardants appear more resistant to heat and drought stresses (2) and even to over-

OPPOSITE EFFECT ON POINSETTIAS: The same treatments given to petunias, at left, were given to poinsettias above. In these Phosfon caused only slightly retarded growth, and the Cycocel excessive dwarfing. Petunias are long-day plants, flowering in summer when days are longest; poinsettias are short-day plants, blooming in winter.

fertilization with inorganic fertilizers (5).

Plants of fatshedera and zinnia are stimulated to grow more rapidly following application of certain dosages of phosfon. Higher levels of application result in browning of leaf margins and stunted growth. Application of CCC retards the growth of these plants.

The photoperiod in which holly, petunia and chrysanthemum plants grow determines their flowering and growth habits (2). Treating the soil with growth retardants does not alter the response to photoperiod, light quality, or night temperature. Therefore, the action of the retarding substances is different from that imposed by short days. Short days continue to be essential for flowering of chrysanthemums and long days for stem elongation of holly and petunia.

Effects of Artificial Light

The use of artificial light in delaying flowering of short-day plants and in promoting the growth and flowering of long-day plants now depends upon application of light for a three- to eight-hour period near the middle of the night. Frequently light at other times of night was only partially effective in controlling growth. Appreciable reduction in the amount of light by decrease in its duration or its intensity was unsafe. The use of artificial light to interrupt the night is now limited to a few high-valued crops.

Intermittent lighting is as effective as continuous lighting, but utilizes one-fifth or even less light without loss of effectiveness by simply turning it on and off intermittently during the three- to eight-hour period in the middle of the night. It is based on the discovery that the action of phytochrome, the photoresponsive pigment, continues for a time after the light goes out. The basic principles of intermittent lighting were established using chrysanthemum plants.

Light-dark cycles shorter than 60 minutes, consisting of incandescent light at 20 footcandles for 5 per cent of the time (examples—three seconds every minute (8), 30 seconds every 10 minutes or 90 seconds every 30 minutes for four hours), each with a total of 4 footcandle hours, were as inhibitory to flowering as continuous light for four hours. The twelve minutes of light in a single period each night did not prevent flowering. But the inhibitory action of light failed to carry through more than an hour of darkness.

EFFECT OF LIGHT PERIOD ON THE CHRYSANTHEMUM VARIETY 'SHASTA.' Above plants were grown in 8-hour days, then during the middle of the night, incandescent light of 20 footcandle intensity was given to the two plants at right. (Plant at left untreated.) The center plant had 4 hours of continuous light between 10 p.m. and 2 a.m. (plus the basic 8 hours, thus giving it "long-day" treatment, which prevented blooming). At right, 12 minutes of light given at midnight did not prevent this plant from flowering; it behaved like the untreated plant. Light treatments were continued for one month. The photographs were made six weeks after the plants were returned to the original 8-hour days. (See text under Effects of Artificial Light.)

In several of the chrysanthemum experiments, plants of various long-day species, such as spinach, barley, hyoseyamus, dogwood, red maple, petunia, and short-day species such as salvia and celosia, were also subjected to cyclic lighting treatments. Results from these plants are not yet complete, but preliminary observations show that growth and flowering of photoperiodic plants are responsive to cyclic lighting and that the amount of light needed to control growth is markedly reduced when such a lighting regime is followed.

Eventually it will be possible to consider, for the first time, using photoperiodic control of many kinds of plants to establish the pattern of growth. Cost of lighting in relation to the unit value of the crop will be greatly reduced by using cyclic lighting. The size of the plant would then be scaled for any purpose by the use of growth retardants.

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HOW NOT TO BUY PLANTS

What one doesn't know about shrubs CAN hurt—
or at least cost time, effort, money—and nervous energy

Theodore A. Weston

WHEN you buy trees, shrubs, and flowers for the first time in your life, you stand a pretty good chance of making mistakes and at least some chance of being misled or actually cheated.

The odds are fairly heavy you'll buy plants that are the wrong kinds for the place you intend to use them. You may buy some that aren't suited to your part of the country. You'll quite likely buy some that are much too small for your purpose. And you may buy some that are quite lifeless, or becoming so.

From what we've discovered in different parts of the country, most new home owners err in one of three ways: (1) they're an easy mark for the smooth-talking door-to-door salesman, peddler, or "landscape gardener"; (2) they're suckers for the newspaper ad that offers "unheard of" bargains; or (3) they can't resist the "drastic reductions" available at the local discount center, supermarket, garden center, or roadside nursery.

Door-to-Door Salesmen

Door-to-door selling is an old and accepted method of retail merchandising. It's both convenient and satisfactory if you know what and from whom you're buying. But it's cat-in-a-bag buying if you don't.

One new home owner told us he'd been stuck buying a foundation planting. "Cost a hundred dollars," he said, "and most of the plants weren't at all what I thought they'd be like. Then half of them died in the winter." He figured he'd been swindled.

But the fact is he had received exactly what he had ordered from the salesman and, as far as he could remember, all the plants had been alive when received. He simply hadn't known what he was buying and, willy-nilly, had made some very poor choices.

Among other things, he ordered a Norway spruce "for height," several "medium-height evergreen shrubs" called hypericum, and some "low-growing evergreens" called iberis. When he got the plants, he was satisfied with the spruce but was thoroughly dismayed by the appearance of hypericum and iberis.

Was it entirely his own fault, or entirely the fault of the salesman, or the fault of both?

Actually there are no more swindlers or hard-sell artists in the nursery business than in any other business, and you're no more likely to be deliberately victimized buying plants than buying anything else. But you *are* more likely to make mistakes—or to fall for sales talk or advertising copy—when you buy something you know nothing about than when you buy something you are familiar with.

In the incident just related, the home owner *could* have learned that the Norway spruce is a giant forest tree not at all suited to foundation planting and that neither hypericum (St. Johnswort) nor iberis (perennial candytuft) is what most people would call an evergreen.

Under the circumstances, you have to admit that the customer was at least partly at fault.

Condensed from *American Home*, February 1962

In another case of poor choice of plants, the home owner placed a substantial order with a salesman and a week or so later showed the order to his brother-in-law, a former professor of horticulture. He thus learned that none of the plants he'd ordered was suitable for his totally shaded garden. So he called the salesman and asked him to make substitutions. But the salesman refused to do so—because the contract had been signed. At his lawyer's advice the home owner notified the company of the situation and, when the shipment arrived several months later, he refused to accept it or to pay the invoice. The plants remained at the express office for weeks and finally were returned to the company.

Here, let's say, both the salesman and the company were at fault and the home owner was just plain lucky. The point the lawyer made was that the order *could* have been changed or the shipment *could* have been held up until the matter was settled. The company did not bring suit and, since the home owner was not required to put a deposit on the C.O.D. order, his only loss was the consultation fee of his lawyer.

In some instances, however, we found that deposits had been made. Sometimes this made the purchaser reluctant to think about trying to change or cancel the order even though advised to do so. But we found one instance in which a purchaser after making a deposit had inspected the plants on arrival, considered them too small, and had rejected the shipment. He tried to get his deposit back, but when he failed to do so he decided to forget the whole thing rather than send good money after bad or get involved in a lawsuit over a few dollars.

In the colder areas—Denver and Minneapolis, for instance—salesmen for out-of-state companies have taken orders for plants that are not winter-hardy or are of doubtful hardiness in the area. Of course, the hardiness or non-hardiness of a spring-planted shrub is not proved till a year later, and what can you do about it then?

The physical condition of plants supplied by companies represented by door-to-door salesmen is evidently satisfactory in most instances. It's infrequent that purchasers complain of plants being dead or half dead when received. But complaints that plants are smaller than expected are commonplace. A Minnesota horticulturist, when checking on such a complaint, found the shrubs to be scarcely larger than what the nursery trade calls lining-out stock. And an Ohio pur-

Lew Merrim photographs

The salesman had said that with this planting the house would look like a million dollars.

But this picture taken the next spring didn't represent the owner's idea of a million-dollar look!

A Russian - olive supposed to take 50 below zero died at 10 below.

chaser of such stock told us that although he "wouldn't call the sale an out-and-out fraud, it was certainly close to it."

Incorrect labeling and substitutions that are to the purchaser's disadvantage are other reasons for complaint. In such cases a non-warranty clause usually absolves the company from responsibility for correct labeling and a reasonable-sounding paragraph in the contract allows it to substitute at its discretion.

Evidently company guarantees are generally honored. Usually these promise that any plants that don't grow will be replaced without charge. But many purchasers neglect to take advantage of guarantees, either from inertia or from lack of confidence in the company. Sometimes, too, the guarantee stipulates that losses must be reported within a certain time and the purchaser doesn't know that plants have died until after the reporting period has run out.

Nursery stock sold from a truck may look like a better deal than an order placed with a salesman. At least you can see what you're getting. But evidence indicates that unless you can identify the plants and can tell whether they're in good condition, properly dug and balled, you're likely to do no better, and may do worse, than buying from an unknown salesman.

"Bargains" in Print

Newspaper ads that most often lead to disappointment are the flamboyant, hard-sell copy that emphasize price more than anything else. They're illustrated with bold photographs or drawings and the copy is loaded with superlatives. Newcomers to gardening get the impression that the plants offered are suitable for immediate use in foundation plantings.

Complaints are almost always about the size of the plants received. Even if lengths or heights are mentioned in the copy, the purchaser seems to get a totally erroneous idea about sizes.

Fifty privet plants, 1 to 2 feet tall, may sound like a sizable batch of hedge plants. But it's likely to be much smaller than your idea of *one* plant! We've seen such privets—rooted cuttings, 12 to 18 inches long, $\frac{1}{8}$ to $\frac{3}{16}$ of an inch thick, unbranched, leafless. The purchaser called them "a bunch of matchsticks."

Such trees as birch, Lombardy poplars, maples, dogwoods are also likely to prove miserably disappointing when ordered from bargain ads. So are flowering and evergreen shrubs. The length of the roots is evidently included in the measurement of some trees and shrubs, and the thickness of the stem and the amount of

The fruit trees never sprouted a leaf; they too were dead, and, like the Russian-olive, they had to be removed.

The 61 "trees" and "shrubs" ordered from a glamorous-sounding ad were unrecognizably small, but they were all in the package.

Lew Merrim

End-of-the-season discount sale: The prices were irresistible, but the plants did not respond to ordinary care, and most of them died.

branching are almost always much less than the purchaser anticipates.

Herbaceous perennials and ground-cover plants are likely to be so small you'll wonder if they're worth planting. In fact, we know of people who have ordered various items from bargain ads and have discarded bulbs, perennials, and shrubs and planted only the trees!

Bulb sizes, incidentally, are often given in circumference, which many people confuse with diameter. (Remember: a bulb that's 3 inches in circumference is less than 1 inch in diameter!) and not all "blooming size" bulbs actually bloom. In numerous tests on record, out of 100 such bulbs planted less than 25 flowered.

Although herbaceous perennials sometimes arrive in a "mushy" condition, the woody plants (trees and shrubs) usually are received in satisfactory physical condition.

At Retail Outlets

A "bargain" at a local retail outlet may turn out to represent a substantial saving, a so-so buy, or a total waste of money. It'll depend on how much you know about plants or on how lucky you are!

Or it may depend on blind gullibility. A friend told us about watching a fellow load a station wagon with packaged dormant roses at a discount center in the middle of June. He went over and told him the plants were totally dead, that none of them could possibly grow. But the man only seemed annoyed by the advice!

Most of the large discount centers, supermarkets, and department stores buy reasonably good quality nursery stock—in some cases exceptionally fine stock. But the employees often know nothing about the handling of plants and can't tell whether they need watering, spraying, shading, or even whether they're alive or dead.

We've seen 18-inch yews—beautifully grown little plants—bounced around like the near-by charcoal briquets. The burlaped root balls were bone dry and reduced to shapeless bags of loose dust.

Evidently the longer plants are on sale at a non-horticultural establishment the less likely they are to be in good condition. So your best bet is to buy them as soon as possible after they come in—not wait until reduced for clearance.

At roadside nurseries and garden cen-

ters you'll often find quantities of roses, shrubs, and trees marked "special," or the equivalent, and priced much lower than other material on display. If you ask the owner or salesman about it, he may say, "It's for people who want cheap stuff." And if you seem critical, he may plead that he "can't afford to let discount houses get all that kind of business."

Usually the "cheap stuff" is satisfactory material but of substandard grade, straggly, and poorly shaped, or of the less desirable species and varieties. As long as it's in good physical condition it'll probably give you your money's worth of satisfaction.

Sometimes, though, "cheap" plants are virtually worthless. We've seen both evergreen and deciduous trees and shrubs with root balls nowhere nearly as large as they should be for the size of the plants. Their chance of survival was close to nil.

Seasonal clearances—at the end of spring or late in the fall—are always risky. Even though a plant is marked down 50 per cent, it's no bargain if it dies during the summer or winter.

How to Buy Wisely

First of all, don't be in too much of a hurry. Learning something takes time. There are quite a few ways you can learn about plants, plantings, and nurserymen, but there's no instant method.

Get to know other home owners, new and old, in the community and take a good look at their plantings. Find out what kinds of plants they have, where they bought them, who designed the planting, and whether the owners have been satisfied. And try to decide what you yourself like or dislike about their plants and plantings.

Buy a few garden books, or borrow them from your library, and make use of them. A book on home landscaping will give you ideas about the kind of plantings you need. A garden encyclopedia will give the important characteristics of all popular plants—whether they're evergreen or deciduous, eventually grow to 2 feet, 20 feet, or 200 feet, the time and color of flowers, and so on. Use this to check on salesmen's suggestions.

Familiarize yourself with the Plant Hardiness Zone Map* so you'll know what plants are suitable for the climate of your area.

If you expect to buy from near-by nurseries, pay them a few visits, and get to know something about them, their plants, and their methods of doing business. If you plan to buy from a mail-order nursery, study its catalogue and check your choices with your encyclopedia.

Final reminder: the more you know about the plants you propose to buy, and about the nurserymen from whom you propose to buy them, the more likely you are to be satisfied with both.

SOURCES OF INFORMATION ABOUT PLANTS

THE office of the county agricultural agent, at the county seat, can supply a great deal of information on plants and perhaps can offer valuable suggestions on landscaping. So can the horticulture department of the State agricultural college.*

The American Association of Nurserymen (635 Southern Building, Washington 5, D. C.), the National Landscape Nurserymen's Association (P.O. Drawer 281, Leesburg, Fla.), and the National Mail Order Nurserymen's Association (Middlebury, Ind.) can all advise of reputable nurserymen.

*EDITOR'S NOTE: And the Brooklyn Botanic Garden's Handbooks, of course.

*This map, with accompanying plant lists, was published in the January 1962 issue of *American Home*, and is available from *American Home*, 300 Park Ave., New York 22, N. Y., as a separate bulletin for 50 cents.

THE SCIENTIFIC APPROACH TO SUMMER MULCHING

John R. Havis

THE use of summer mulches has long been recognized as good horticultural practice. Observant gardeners have seen response to mulches in healthier, more vigorous growth of ornamentals, larger yields of vegetables and fruit. The reason for these beneficial effects, and some possible deleterious ones, may not be well understood. Our purpose, then, is to discuss the effects of mulches on soils and plants, with the gardener in mind, but drawing strictly on scientific evidence.

A bibliography on the subject of mulching would list several hundred scientific papers spanning more than a century. The research on this subject has been conducted largely on field and orchard crops, but the principles can be applied to the home gardener.

For our purpose, mulches are defined as natural materials: mineral, such as gravel; organic, such as peat, leaves, sawdust or shavings, hay, straw, or other crop wastes; or manufactured materials, such as paper, foil, polyethylene, and the like. It does not include the so-called dust or soil mulch.

Weed Control

Much has been said recently about chemicals for controlling weeds. They have a place for certain lawn problems, but weed killers should not be used in the home vegetable garden, flower or shrub border. Mulches are the most practical method of controlling weeds in the home garden. The soil should be free of weeds when the mulch material is applied. Mulch reduces weed growth by blocking out light on the soil surface and, therefore, on the young weed seedlings. Weed seeds contain sufficient stored food to support the young seedlings for a limited time. When the stored food is gone, the leaves of the young plant must be making new supplies of food, or the plants will die. To control weeds, the mulch must be deep enough that the young weed seedlings cannot grow through it on stored food, and it must block out enough light so that the seedling leaves cannot carry on photosynthesis. As far as weed control is concerned, therefore, the kind of material used for mulching is unimportant as long as those two conditions are met.

There is one other point, however. The mulch material itself should not be a favorable medium for growing weeds, or else control may be unsatisfactory. Animal manures, often mentioned in older literature, give poor weed control for this reason, and, even worse, they are rich sources of weed seeds themselves.

Burns, Schenectady

A mulch of black plastic effectively keeps out weeds. To enable rain water to reach the roots, it should be slit at intervals. (Photograph courtesy of *Horticulture* magazine.)

Condensed from *The American Horticultural Magazine*, October 1962

Roche

Leaf mold makes a loose and porous mulch, which permits required air to reach roots.

Soil Moisture and Erosion

One of the often mentioned benefits of mulching is the maintenance of a higher and less variable moisture level in the soil. Mentioned in the same breath, and often given as the primary reason for mulching, is the prevention of soil erosion. With sufficient repetition, these advantages may be accepted without serious question but the inquiring gardener may well ask, "How does it maintain a more uniform level of moisture?" and "Why does a mulch prevent soil erosion (or washing)?" These are logical questions and their answers are interesting to explore.

One of the most important benefits of a loose, porous mulch is the ease of penetration of water from rain or irrigation. Most of us know from experience how slowly water penetrates a hard crusted soil surface. We know that a crust will shed much of the water from a spring or summer shower; that the plants will get little benefit, because the crust seems to be almost impenetrable, and further that such shedding of water causes soil erosion. Most of us feel that breaking up the crust (or cultivation) makes the soil more receptive to the water from showers or irrigation and, therefore, less run-off occurs. We may be surprised to learn, however, that this benefit of cultivation on unmulched soil lasts for only the first few minutes of a shower. Soil physicists have found that the action of rainfall on the soil surface is to disperse the soil particles, resulting in the packing of small particles between the larger ones so that the pores are plugged and water cannot penetrate freely. This condition of the soil, when dried, is the well-known surface crust!

Bear in mind that this action on the soil particles is merely from raindrops (or irrigation drops) falling on the bare soil. A suitable mulch over the soil absorbs the physical impact of the raindrops, delivering the water gently to the soil surface and thus preserving its pore structure or receptive ability. Surface crust does not form. This is why a porous mulch allows greater penetration of water from rain or irrigation, less run-off, and less soil erosion.

We normally think of straw, shavings, and the like as typical porous mulches that would accomplish the improved water penetration. Plastic sheeting can do the job equally well if small slits are made at intervals to allow penetration of water.

Checking Evaporation

Mulches may also reduce the rate of loss of soil moisture by evaporation.

In order to visualize how mulches can check evaporation we need to understand what causes evaporation. Evaporation takes place in response to a gradient in vapor pressure. This means that moisture vapor moves from a region of high humidity to a region of low humidity and the movement becomes more rapid as the temperature rises. Thus, evaporation from soil will be reduced when the soil surface and the air immediately over the soil are cooled, and when air over the soil surface has a high humidity. Mulches such as straw, sawdust, peat and the like obviously shade the soil and reduce the temperature as compared with uncovered soil that is exposed to the sun. (This effect on soil temperature is explored in

Roche

Hay may be unsightly in a flower garden, but on these bush beans in the vegetable garden it prevents evaporation and keeps the space between rows free of weeds.

more detail later in this article). These mulches also increase the humidity of the air immediately over the soil surface because they act as insulation, slowing the movement of vapor into the drier atmosphere above the mulch.

Merely shading bare soil can reduce evaporation 36 per cent, but straw mulch will reduce evaporation 73 percent as compared with bare soil exposed to the sun and wind.

Experimental data obtained in 1883 show 84 to 90 per cent reduction in evaporation over a one-month period from two inches of chopped straw, beech leaves, pine needles and fir needles. In the same experiment one-fourth inch of chopped straw reduced evaporation about 58 per cent. This thin layer shaded and thereby cooled the soil, but the two-inch depth gave greater insulation.

There is evidence that mulches conserve moisture primarily in the upper six to ten inches of soil. Mulch may give no benefit in yield when the roots of the trees are deep and extensive, but plants that depend largely on moisture in the upper six to eight inches show marked benefits.

A rather minor consideration, perhaps, but one that does affect loss of soil moisture is the influence that mulches may have on the relative rate of transpiration by plants. Transpiration is the loss of moisture through the leaves. A highly reflective surface underneath plants causes higher radiation to lower surfaces of the leaves and increases transpiration. A recent report of experiments shows that, as compared with bare soil, mulches such as tar paper and foil caused significant increases in transpiration. Hay, black film, and dusty translucent film had no effect.

Soil Temperature

A summer mulch of plant residues, peat, and the like usually has a cooling effect on the soil. More striking is the smoothing out of daily and weekly fluctuations in temperature. This effect is most noticeable in regions of highest summer temperatures, as might be expected. Records from Puerto Rico, for example, show fluctuations of as much as 38° F. in a 24-hour period on unmulched soil but only 12° F. on mulched soil.

A few investigators have thoughtfully measured the mulch material itself and recorded temperatures about as high as bare soil. The soil below remains cool if the mulch material is a poor conductor of heat. This means, from a practical standpoint, that a loose and dry mulch protects against a high temperature extreme better than a wet or compacted material such as paper.

The color of the material may or may not be important. Black paper may raise the temperature higher than bare soil, whereas white paper moderates midday temperatures through greater reflection. With poor conductors, such as hay, on the other hand, only very small differences are measured under dark, weathered material as compared with bright, unweathered straw.

This slightly cooling action in the summer, and the greater uniformity of soil temperature, are assumed to be beneficial to most plants. A saving in the rate of evaporation of soil moisture (al-

ready discussed) may be the most important actual benefit to the plants. Research literature is a bit deficient on the total plant responses to independent variations in root temperature. A disadvantage of mulching too early in the season has often been observed in delayed growth from preventing the soil warming as rapidly as uncovered soil.

This problem of cold soils in the spring has been given some attention by research people in Connecticut, Maine, and elsewhere. In Massachusetts, earlier ripening of melons that were mulched with black polyethylene has been observed. It has been commonly felt that the reason for faster growth and earlier maturity was that the black plastic raised the soil temperature early in the season and forced the plants to start faster. But in Connecticut, black polyethylene mulch increased the soil temperature by only about two degrees for the entire growing season. The higher temperature resulted largely from preventing as much drop in temperature at night. The black plastic itself got very warm on a sunny day and emitted a great deal of heat to the air above it. It is possible that the faster growth of melons could be caused more by warming the leaves than the roots?

Soil Aggregation and Porosity

High porosity is a desirable characteristic of soil because it provides free movement of moisture and allows good aeration for plant roots and for activity of beneficial microorganisms. Porosity varies with the soil texture, that is, the relative proportions of different size particles, soils with more sand and gravel being more porous than soils with high clay content. More important, perhaps, is the improved porosity due to increases in soil aggregation. Most gardeners appreciate good aggregation intuitively. They recognize it as good tilth or say the soil "feels good." In order for the soil particles to form aggregates (or granules) a bonding or cementing agent is necessary. This cementing agent is humus, which is the decomposition product of organic material.

The improvement of aggregation is probably the most important reason for incorporating readily decomposable organic material into garden soils. It is also a benefit of mulching with organic materials that gradually decompose, with the break-down products being carried into the soil by rainfall. Of the dozen or so studies of the effects of mulches on aggregation only a few have found measurable improvement in as short a time as one or two seasons. The measurements that show great improvements are those that are made in soils that have been under mulch continuously for ten to twenty-five years. A more rapidly decaying mulch material would probably produce faster results.

The influence of earthworms on soil aggregation and porosity should not be ignored. A higher earthworm population is usually found under mulches because they are protected from temperature extremes, moisture conditions are favorable, and decomposing mulch material provides food. Counts have shown considerably higher earthworm populations under decomposing plant residues such as straw, leaves, and the like, than under relatively inert material such as paper and burlap.

Chopped sugarcane, sold as chicken litter, is one of several useful mulches derived from plant wastes. High nitrogen fertilizer should be added when it is applied. Possible disadvantage: residual sugar may attract ants. *Roche*

We are not aware of aggregation measurements under polyethylene plastic mulches but would expect little improvement since these materials would contribute neither organic material for cementing soil particles nor food for earthworms.

Soil Acidity

Most mulching materials have an insignificant effect on soil acidity. In tests where soils under mulches become more acid, it was seen that corresponding unmulched soils also became more acid. Many gardeners mistakenly believe that sawdust and oak leaves have high acidifying effects. But, contrary to popular belief, experiments have shown that sawdust does not cause the soil to become acid.

Soil Nutrients

The use of mulches can both decrease the amounts of certain plant nutrients and increase other nutrients. The effect depends on the mulch material that is used. Nitrogen is the nutrient that most often is made deficient for plant growth. Potash is the nutrient most often increased, with phosphate and calcium affected occasionally to a lesser degree.

A mulch material such as sawdust can actually rob the soil of nitrogen and cause stunting of plants unless additional nitrogenous fertilizer is added along with the mulch. The reason for this "robbing" of nitrogen is that the bacteria that decompose the mulch require a certain ratio of nitrogen to carbon for their diet. A 1 to 20 ratio of nitrogen to carbon is about the break-even point for mulches. Usually, a material that contains about one per cent nitrogen does not rob soil of nitrogen. If the mulch is carbonaceous, that is, mostly carbon and very little nitrogen, then the bacteria will take the necessary supply of nitrogen from the nearest source, which is the soil. The fact that the stolen nitrogen is eventually returned to the soil at the completion of the bacterial action is comforting but does not help the immediate situation. The obvious answer to the problem is to supply extra nitrogen from commercial fertilizer sources to approximate the ratio needed by the bacteria. For fresh sawdust this is about one pound of nitrogen to each 100 pounds of dry sawdust. The following supply one pound of nitrogen: 2.2 pounds of urea; 3.3 pounds of ammonium nitrate; 6.25 pounds of sodium nitrate; 5 pounds of 20-10-5 fertilizer; 10 pounds of 10-6-4 fertilizer; 20 pounds of a 5-10-10 fertilizer; about 16 pounds of an activated sewage fertilizer.

Many other materials often used as mulches, such as straw and shredded sugar cane, are also carbonaceous and additional nitrogen may be advisable. Shavings and chips cause less trouble because their particles are larger and thus break down more slowly.

Potash is almost always significantly increased in soil by mulching. In most instances the additional potash is believed to have been leached out of the mulch material. Potash in plant material is almost wholly water-soluble and subject to leaching. Grasses, straws, and hays contain up to one per cent by weight potash. A generous mulch of such materials would supply a significant amount of this nutrient element.

Certain plant residues, for example tobacco stems and cocoa shells, carry sufficiently high levels of potash to cause injury to certain plants. Tobacco stems contain about 6 per cent potash, and cocoa shells about 3.5 per cent. Work at the Waltham Field Station of the University of Massachusetts demonstrated severe injury to azalea and rhododendron from cocoa shell mulch. Examination revealed that not only were there no roots directly under the mulch but that roots had been killed in the soil 3 to 4 inches below the mulch. Extremely high levels of potash were found in the soil, and it was believed that excess potash toxicity caused the death of the roots and subsequent injury to the plants.

Getting back to normal levels of potash, some increase in the soil has been observed under materials such as glasswool that could not contribute the element. It has been suggested that an increase in available potash is an indirect

benefit of the more uniform moisture and temperature levels under mulch.

Root Distribution

Cultivation around plants destroys roots in the upper zone that often is richest in nutrients. Drying of the surface soil also makes unfavorable conditions for root growth. Weeds and grass are strong competitors for moisture and nutrients near the soil surface. A good mulch obviously encourages surface rooting by controlling weeds, retaining moisture and eliminating cultivation.

Root growth near the soil surface, and often directly under the mulch or in the mulch itself, is commonly observed. Favorable moisture and temperature conditions allow the roots to exist in upper layers where good aeration encourages growth. Plants also develop as extensive a root system under mulches as they do in bare soil. Thus the surface roots are in addition to the usual root distribution. Sometimes the mulched plants concentrate most of the roots near the surface. This would probably occur in wet or heavy soils where deep rooting would be limited by poor aeration. The type of root distribution varies with different kinds of plants, of course.

Roche

Buckwheat hulls: neat, clean and porous, and they break down slowly.

Summary

We have seen that the use of summer mulches brings about some rather important changes in the soil and in the environment for the roots of plants. Mulches would be worth while in many situations if they accomplished nothing more than to keep down weeds. The improvement in moisture penetration and retention, moderation of soil temperature fluctuation, improvement in aggregation and encouragement of surface rooting, all amount to exceptional advantages to be gained by judicious use of proper mulches.

Mulching is not always advantageous, however, as has been mentioned. The application of a mulch early in the spring may delay warming of the soil unless a clear plastic is used to trap the heat and hasten warming. Certain materials, highly carbonaceous, can bring about nitrogen deficiencies unless some extra fertilizer is supplied. This really should not be considered a disadvantage, but merely a point to be remembered. The wrong mulch materials can cause damage to the plants. Products rich in nutrients, particularly potash, should not be used as mulches but should be used as fertilizers and at appropriate rates.

For those wishing to pursue further the scientific aspects of summer mulching, the following sources are suggested.

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*The Brooklyn Botanic Garden's Handbook on Mulches ($1) might also be mentioned as of special practical value to the gardener.—Ed.

MAKING THE MOST OF TREE-SHADED PROPERTY

A garden of uncommon interest can be developed where sunshine is lacking

Henry B. Aul

PROPERTIES having many trees are likely to be special problems for the home gardener who wants to give the grounds a trim, well maintained appearance throughout the year. This is especially so where the trees are concentrated on the garden side of the house, the side generally developed as an area for outdoor living.

Yet the handling of these problems can result in solutions having more than the usual interest. While grass and regular garden flowers do not grow well in dense shade, there are ground covers and taller growing shrubs and trees that do very well under these conditions. Many small native plants, the spring-flowering bulbs and a limited number of the cultivated perennials will produce pockets of color.

Gravel and tanbark maintained in paths and as clean open areas between the plantings will permit free circulation throughout the grounds. Close-to-the-house space may be set aside for a spacious paved lounge elevated a step or two to afford a pleasing view across the grounds.

These are features which have been made a part of the 72-by-75-foot wooded garden shown in the accompanying illustration. There are 23 trees of assorted sizes in this back yard. They are clean-trunked, high-headed oaks, maples, beech, birch and sweet gum, the oaks predominating. While creating too much shade for the usual lawn and garden, they do afford a beautiful background for the house and shelter it from the hottest southwest summer afternoon sun.

The trees present an attractive appearance as seen from the house and breezeway porch. The large paved terrace has been located to take advantage of their shade and beauty. Built of pebble-surfaced concrete marked off in large squares, the straight lines of the paving contrast refreshingly with the gracefully curved lines which have been established to separate the tree and planting areas from the open gravel paths and spaces between the trees.

Locations of the trees determine the shapes and proportions of these areas. The curving lines bounding them at the same time blend them into the site and contribute to the interest of the garden. These lines are marked permanently with a masonry, metal or plastic edging that keeps both gravel and planting in their respective places.

A clipped hemlock or yew hedge along the north property line shelters the garden, terrace and the house from cold winter winds. Shrubs and trees to form the border plantings that enclose the garden on the other sides and that provide a background against which to see the curved garden areas at their best are chosen from among those plants that are associated naturally with the existing trees.

There are the shrub and tree dogwoods, mountain laurel, many of the viburnums, pinxterbloom, downy pinxterbloom and several other deciduous azaleas, the New Jersey tea (*Ceanothus*), black-alder (*Ilex verticillata*), the various witch-hazels, shadbush (*Amelanchier*) and high- and low-bush blueberries. Evergreen tree accents might be Canadian or Carolina hemlock or upright Japanese yew.

Periwinkle (*Vinca minor*), carpet bugle (*Ajuga reptans*), lily-of-the-valley (*Convallaria majalis*) and epimedium are

Reprinted from the New York *Herald Tribune*, May 20, 1962

good flowering ground covers to consider. Different ones are used in different sections of the garden.

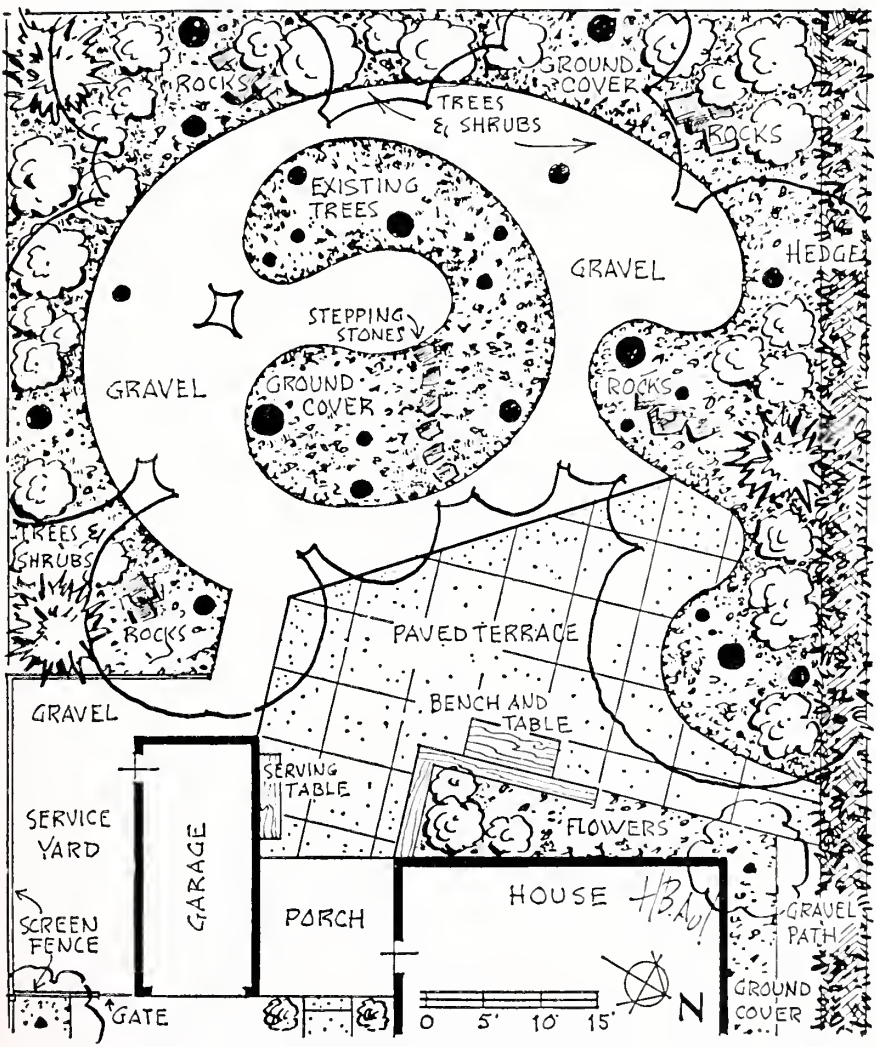
Selected pockets and promontories in the enclosure borders are planted with a combination of native plants that do well in shady locations. They are grouped between and in front of the shrubs and trees along with choice rocks or picturesque pieces of driftwood or weathered wood in the form of branches, roots or small stumps to provide interesting settings for the plants.

Plants to consider in these spots, besides spring-flowering bulbs, include violets, red cardinal flower, blue lobelia, white snakeroot, fringed bleeding heart, the hardy *Begonia evansiana*, ferns in variety, Solomon's seal and many others. Once planted, they are allowed to naturalize and take care of themselves.

Close to the terrace, the border between the paving and house is sufficiently sunny to receive compact-growing annuals, begonias, impatiens and hardy chrysanthemums.

Many of the trees and shrubs used in a semi-naturalistic planting of this type produce berries which attract the birds. Further encouragement will be given by installing feeders, houses and basins for water. There are excellent locations for all of these as well as garden sculpture. The recessed bay in the border as it curves into the paved terrace is an obvious spot for the latter.

Design for the tree-shaded garden described here.



REQUIEM FOR A GARDENER

Beverley Nichols

MR. A. E. Newby, of the little village of Ashtead in the County of Surrey, England, has gone to his rest, at the age of eighty-four.

He always used to say to me, "I want to work out, not rust out. . ." pronouncing the word *rust* with a soft Lancashire burr, as though it were spelt *roost*. Well, his wish was granted. A few days before he took to his bed, he was digging his vegetable plot in his cottage garden, and when he hung up his spade for the last time, it was bright as burnished silver.

That bright spade was the symbol of his life.

I shall always remember my first sight of him. It was a sweltering afternoon in July, 1948, and I was making my first trip through the gardens of Merry Hall, the old Georgian house that I was to own for ten happy years.

I stepped out alone and crossed the lawn and walked through a narrow doorway into a vast kitchen garden, which was, in itself, larger than any garden I had ever owned. But all sense of size or practicality was forgotten, for there, stretching before me, was a long bed of the most magnificent royal lilies (*L. regale*) I had ever seen. They soared to a height of nearly four feet and some of them had as many as twenty blooms to the stem.

I stayed there, transfixed. Suddenly I realized that I was not alone.

He walked towards me slowly, holding himself very upright. He wore a battered old straw hat and—in spite of the temperature—a thick woolen waistcoat . . . "to keep out t'heat." He came to attention in front of me and looked me straight in the eye. As he did so, I noticed that one of his eyes was blind.

"And what," he demanded, with a curious blend of ferocity and deference, "may I do for you?"

Virginia Howie

I explained briefly that I might buy Merry Hall and if I did, I hoped to retain his services.

To this he responded only with a sniff. (Rain or shine he always had a dewdrop on his nose.)

Feeling faintly discouraged, I congratulated him on his lillies and then, somewhat lamely, enquired from whom he had obtained the bulbs. He suddenly came to life.

"Boolbs?" he snorted. "*Boolbs?* I've never grown 'em from boolbs. Those lilies come from a handful of seed t'parson give me, forty years ago. *Boolbs!*"

And at that moment I decided that whatever happened I must have Merry Hall. And that I must also have Mr. Newby. And I did.

We "dealt together"—as they used to say in the days of the Regency—very

Condensed from *Popular Gardening*, September 1962

well, indeed. However, in the actual conduct of the garden, in the care and culture of his plants, he was a conservative of the conservatives. Every year after the Chelsea Flower Show I would come home laden with modern devices—new gadgets for potting, spraying, hedge-clipping, new insecticides and fertilizers. And I would carry them out to the toolshed and display them on his immaculate table—with no result whatever.

About some things he was almost fanatical. One of these was the importance of watering. It would obviously be untrue to suggest that he watered himself to death, because he lived beyond the allotted span, but sometimes I was afraid that he would do so. Time and again on hot summer evenings, after a long day's work, I would see him trudging across the lawn towards the old tank under the fig tree and lifting his watering cans into the dark, tepid water, and staggering down the path towards the lily bed. Time and again I would go out to remonstrate with him, telling him that he had done enough, that it wasn't all that necessary. Once I even suggested that surely he might save himself trouble by using the hose. Never shall I forget the look of awful, majestic reproach that greeted this ill-timed observation.

"T'hose?" he mumbled. "Use t'hose?" He drew himself up to his full height and glared at me with his one good eye. "I been watering these lilies forty years with fresh water from t'tank, and you ask me to use t'hose? No sir. I never did and I never shall."

During my last two years at Merry Hall, Newby was in semi-retirement. His eighty years of unremitting labour had begun to tell. When, with a heavy heart, I came to leave—for my friends had been all too correct in their prophecies—he pressed into my hand a packet of seeds that he had saved from his royal lilies.

"These'll serve you better than any boolbs," he muttered.

And they did. When the time came, I laid on his grave a bunch of lilies grown from that seed. Nearly four feet high they were, and some of them had as many as twenty blooms to the stem.

SCOTTISH LANDSCAPE WITHOUT HEDGES?

BIRMINGHAM, ENGLAND

LATELY I received a letter from a friend in Ayrshire, Scotland, in which she told me that the farmers there were thinking of doing away with the hedges that divided their fields so as to give greater freedom in using their modern machinery.

I fell to thinking of the hedges in our Warwickshire and Worcestershire country lanes where we wandered as children, and of the deep, beautiful hedges of the Devonshire lanes in the walk I once took from Ilfracombe to the Village of Lee.

Wild roses trailed over them, and no doubt blackberries in their season would be discovered in their leafy depths. Hedges were made for wild roses, for poems and songs about the wild rose. Without hedges—alarming thought—there would be no wild roses. And there would be no blackberries, no happy children—and grown-ups—looking for berries. Gone would be half the charm and fun of the country walk in September.

What would become of the habit of lying under hedges, for shade, for rest, for reflection; maybe to shelter from the storm, or to play hide-and-seek with children? And what about the glory of wildflowers that children pick in hedges?

The more I thought of it, the more I thought that we must save our hedges, farmers or no farmers, modern machinery or old. This letter from my friend has awakened me to an appreciation of hedges in lanes and fields that I have never known before.

LAURA J. HEMMING

Condensed from *The Christian Science Monitor*, January 28, 1963

Erskine, courtesy of Sunset Magazine

BONSAI COLLECTION artistically displayed against translucent white panels that diffuse light and protect plants from wind. Tall trees overhead give filtered shade. The 40-inch-high table exhibits plants at a good height for viewing. Design by Kenneth Osaki

BONSAI IN CALIFORNIA

Seven accomplished hobbyists tell how they handle their dwarfed potted trees

COLLECTIONS, each containing from 50 to 850 bonsai are kept in sheltered areas outdoors by some of California's most ardent growers of bonsai. A symposium in which seven growers divulge their practices and make recommendations to beginners appears in *Sunset* magazine (Central Edition—northern California, Nevada, Utah) for November 1962.

For displaying these plants, and caring for them too, benches, tables or tiered shelves made of 2x12 rough redwood are favored by most. Supports are of wood, bricks, concrete blocks, or sculptured concrete. Some of the collections are grown and shown in tea-houses, but the majority remain outdoors with lath or light-foliaged trees for overhead protection and reed screens for a backdrop to shield the plants from wind. Translucent white panels diffuse the light and disperse the breezes from one collection.

While conifers, including the deciduous larches, are outstanding when trained as bonsai, these California growers also use many broad-leaved trees. They are training maple, elm, wisteria, fruit and nut trees, holly, olive, date, oak, willow, beech, birch, nandina and pomegranate.

Soil mixtures and methods of watering vary from grower to grower, and fertilizers differ similarly. Here are the combinations preferred by the seven amateurs:

1—Mrs. Charles Robinson, San Rafael: Four parts of heavy soil, two of sand and one of leaf mold, pulverized and sifted; watered with a fine mist daily (more in summer); fertilized with liquid 10-10-5 with organic base, one tablespoonful in a gallon of water, in early autumn and again in late November.

2—Tom Laman, San Francisco: Equal parts of soil, coarse sand and peat moss or leaf mold, sifted together and the finest residue discarded; watered with a finely

Adapted from *Sunset* Magazine, Menlo Park, California, November 1962

divided stream from a nozzle, plus a fine misting spray from overhead, daily in summer, other times twice a week; fertilized, for convenience, with commercial formulations (approximately 11-15-20); if the collection were smaller, the preferred, organic fertilizers would be used.

3—Mrs. W. Leonard Renick, San Francisco: Equal parts of loam, leaf mold and sand; watered by hand, using both hose and watering-can; fertilized monthly with dissolved plant tablets or with fish emulsion.

4—Philip Lanzit, Alameda: Potting soil with peat moss and sand added; watered every day by hand; fertilized with small amounts of ammonium phosphate and fish emulsion.

5—Cameron Ashby, Moraga: Two parts of topsoil, one of sand and one of coarse soil, with extra sand for conifers; watered with an overhead misting system.

6—Ben Sisson, Sacramento: Equal parts of garden loam, coarse sand and leaf mold; watered with an automatic system, ten minutes at sun-up, five minutes at 5:30 p.m. all summer (less in winter), plus hand watering where needed; fertilized with fish meal, cottonseed meal or fish emulsion plus a dilute fish-based 15-5-5 mixture, applied according to age and condition of plant.

7—Robbie Robinson, Fresno: Equal parts of loam and sand; moistened a little every day from a watering-can; fertilized with a low-nitrogen liquid food.

Only one of the growers queried mentions insect control. This one uses an all-purpose spray at 60-day intervals.

As to reference books: three of the seven growers prefer "The Japanese Art of Miniature Trees and Landscapes" by Yuji Yoshimura and Giovanna Halford.* One votes for "'Bonsai' Miniature Trees" by Norio Kobayashi;** one "Bonsai—Miniature Trees" by Claude Chidamian;*** and two for the Brooklyn Botanic Garden's "Handbook on Dwarf Potted Trees, the Bonsai of Japan"**** (currently in its 5th edition, revised).

Advice to beginners given by most of the growers is to read and talk about bonsai at every opportunity, take a course and join a bonsai club—organizing one if necessary. Others stress the necessity of daily watering and, here or elsewhere, the importance of filtered sunlight. Perhaps the most significant statement is that "patience is the most important single factor for success."

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*Charles M. Tuttle & Co., Rutland, Vermont, and Tokyo, Japan. $7.50.

**Japan Travel Bureau, Tokyo. $3.

***Van Nostrand, Princeton, New Jersey. $3.95.

****Brooklyn Botanic Garden, Brooklyn 25, N. Y. $1.

EDITOR'S NOTE: The splendid book by Kan Yashiroda "Japanese Miniature Trees, Their Style, Cultivation and Training," published in London by Faber and Faber, is not well enough known in the U.S.A. (30s); now available from Charles T. Branford Co., Newton Center, Mass. $5.75.

STURDY TABLES designed by Malcolm G. Smith provide display space for this collection of bonsai miniatures. Though open to the sky, the area is shaded from afternoon sun by the adjoining house. *Dawson, courtesy of Sunset Magazine*

BETTER FRUIT IN SMALLER SPACE

Pillar system of growing apples provides consistently high annual yield

Pam Hutchence

READERS who want to improve their fruit trees might like to try a method of pruning which Mr. Gordon Maclean has developed on his fruit farm in Berkshire [England]. He has proved that trees trained and pruned on his pillar system give a high yield of fruit that varies little from year to year—some 75 pounds of apples from a mature tree. Although the method can most easily be carried out by training the tree from the maiden stage, it is possible to adapt a mature tree to the system, especially if it has a number of reasonably upright branches.

Pruning pillar trees, although detailed, is simple because it is done entirely by rule of thumb. After a shoot which has fruited has been cut back to a short stub, two new young shoots arise from it in the following season. One of these is always removed completely, the other is left untouched. In its second season this remaining shoot develops fruit buds and also makes some extension growth, so in the following winter it is cut back to the top fruit bud. It fruits in the next summer and is then cut back to a short stub and the whole process begins over again.

By this method of hard pruning more than half the new wood produced each year is removed, but this in turn encourages more new growth and the tree is constantly rejuvenated; very little nitrogenous fertilizer need be used on trees pruned by this method. The ratio of foliage to fruit is kept constant at about 24 leaves to the apple, which is considered to be the ideal number, and this limited amount of foliage allows light and air to penetrate to the fruit and improve its finish.

It is vital that these pillar trees should have a strong upright main stem, and this is the method Mr. Maclean adopts to produce the sort of tree he requires.

Mr. Gordon Maclean prunes one of his high-yielding, pillar-trained apple trees.

Condensed from *Gardeners Chronicle Gardening Illustrated*, April 28, 1962

Cutting back a third-year lateral which has fruited, and (*right*) the next year removing one of the two first-year shoots arising from such a stub.

Cutting back extension growth on a second-year lateral.

Maiden trees are planted in rows 12 feet apart and spaced 6 feet apart in the rows; after planting they are cut back to 30 inches from the ground. In the year after planting the leading shoot is shortened by a third and the two laterals below it cut back to short stubs; if well spaced, the rest of the side shoots are left untouched. This process is repeated until the tree is about 10 feet high, when no further extension growth is permitted, and in the meantime the lower laterals are pruned on the three-year plan described above.

For varieties which are tip-bearers, or in which for some reason the second-year laterals have not produced fruit buds, the method can be adapted, treating unfruitful two-year-old laterals as one-year shoots, and leaving them unpruned until the third season of growth, when they should be cut back to a stub.

VICTOR LEMOINE

Famed French hybridizer was the originator, a century ago, of many of today's widely used garden plants

Anne Wertsner Wood

FOR such a noted plantsman and hybridizer as Victor Lemoine, it is amazing how little material about his life and accomplishments has been published in England. Considering the fact that he gave us a whole new world of flowers it was strange to find so little material available in the best horticultural libraries in the country, the French Embassy, the French Education Center in New York and the Botanical Gardens.

If one looks back to what we know of horticulture in the past few centuries, one discovers that very often taste for gardens has nothing to do with taste for plants. Probably Louis XIV did not know the difference between a pansy and a viola, but he was very proud of the wonderful garden made for him at Versailles by LeNôtre. This was true of many of the outstanding gardens which, even today, are perfection of design and harmony between the palaces and the surrounding grounds.

In France the fashion was to decorate gardens and parks with statues, waterfalls, and garden ornaments, and the French could not understand how the Dutch collectors of the 17th century had a passion for rare tulips. The early collections of plants by the French were of boxwood or yew cut in topiary form, like musical instruments, birds or animals. It was not until the 19th century that France had a well-known collection of plants. This was a collection of roses from all over the world for the garden of La Malmaison for the Empress Joséphine, first wife of Napoleon. This was inspired by the new plants that were coming back to the country by ship from China, America and the Cape of Good Hope.

A Gardener's Heritage

It was fortunate that such a great plantsman, hybridizer and horticulturist lived at that time. He was Pierre Louis Victor Lemoine, born October 21, 1823 at Delme, Lorraine, not far from Nancy, France, where he died in December 1911. His family had been gardeners for generations and he imbibed much garden lore as a child. His schooling was thorough and he studied at the College of Vic sur Seille; then he worked in the principal horticultural establishments of France and Belgium, such as Van Houtte in Ghent and Bauman at Bolwiller. He came to Nancy in 1850 as a married man and settled there, where he produced some of the most beautiful perennials, annuals, shrubs and greenhouse plants of the time. A large proportion of our present-day garden flowers were originated by Victor Lemoine.

He owned a substantial home with greenhouse and gardens. He was highly intelligent, forceful, determined, and his picture shows him with the uncomplicated and direct look that so often characterizes a man who works in the soil.

His character is shown in the immense amount of work he accomplished, producing some new plants every year from 1852 until almost the year of his death, in his 89th year. It was said of him that every plant he introduced was handsome, well-shaped and of excellent color. He also worked for hardiness.

Lemoine was a devoted family man and named many of his plants after his wife and his daughter-in-law, Mme. Emile Lemoine. He was also very patriotic and named many plants La France, La Lorraine, La Belle Nancienne. Gloire too, meant much to him, as we see by Gloire

Condensed from the *Bulletin of the Garden Club of America*, November 1962

Victor Lemoine, famed French nurseryman and hybridizer, from a portrait in *Revue Horticole,* 1912.

de Nantes (Nancy), Gloire de Lorraine. His lilacs were named for great scientists, authors, inventors, statesmen.

He was a member of the town council of Nancy during the eighties and was active in horticultural societies of his day. He also wrote for journals and exhibited at shows. At his death he was an honorary member of the Royal Society of Agriculture and Botany of Belgium, of the Royal Bavarian Society of Horticulture in Munich and a corresponding member of the Massachusetts Horticultural Society in Boston. He was the first foreigner to receive the Veitch medal from the Royal Horticultural Society in England and shortly before his death he received the George White medal from the Massachusetts Society.

Period of Discovery

Lemoine lived in the golden era of French horticulture. Many French missionary explorers (notably Father David) responsible for the horticultural revolution that happened in France a hundred years ago, sent home seeds and plants from China. The French government was aware of the importance of these discoveries and helped to finance some of the priests. The Vilmorins had gardens in which these newly discovered plants were grown. Catalogues of the contents of the garden were published, one in 1904 and one in 1906, which contained over 6,000 plants. Lemoine was in touch with all that happened in the plant world and received any plants or cuttings he desired.

Among the hundreds of plants produced by Lemoine the first was the double portulaca. Next came the first double potentilla; streptocarpus hybrids and fuchsias followed. A white form of *Spiraea callosa* came in 1862, and in 1866 *Hydrangea paniculata grandiflora,* the Peegee hydrangea of our present nurseries. By 1868 he began introducing hybrid weigelas, still the leaders in their class, and many of his varieties, Abel Carrière, Florial, Vésuve are found in gardens everywhere.

A Host of Finer Flowers

He wrought improvements in Japanese anemones, phloxes, astilbes, clematis, including the large-flowered *Clematis jackmani,* also deutzias, viburnums, heucheras, asparagus, berberis, abutilons, dahlias, montbretias, spireas, chrysanthemums, cotoneasters, buddleias, saxifrages, heliotropes, hibiscus, primulas. He worked with delphinium long before Blackmore and Langdon. In 1893 he produced the begonia Gloire de Lorraine, best known to the florist trade, and many others. It has been said that one American florist who propagated this begonia in quantity when it was new, made more money from it than the Lemoines, father and son, made in their lives. This illustrates the commercial aspect of the American flower industry, as compared to these Frenchmen who have given their lives to horticulture for its own sake.

He did a great deal with mock-oranges. By crossing *Philadelphus microphyllus,* the little-leaf mock-orange, with common types, he produced a whole line of mock-oranges that bear his name, the best being the semi-double Bouquet Blanc, Avalanche, Glacier, Candelabre, Atlas.

What he did with lilacs is not less astonishing. In the varieties with single flowers he created many novelties that were so much ahead of his time that they are still not in use. He gave us such varieties as Jacques Caillot, President Viger, Gloire de Lorraine, Pasteur, Paul Thirion. More notably he crossed *Syringa oblata* with *Syringa vulgaris azureaplena* and produced *Syringa hyacinthiflora plena,* 1878, the first lilac with double flowers that ever was known to exist. From these he produced Madame Lemoine, a double white from which all the present double lilacs are bred. In singles he brought out types that are still of top-flight—the claret Pasteur, purple carmine Réaumur and the deep red Congo. He also brought early bloom into lilacs with Lamartine, Pascal and Claude Bernard.

To the world of peonies he made many diversified contributions. He crossed *Paeonia sinensis* and *P. wittmanniana* and developed many new varieties of herbaceous peonies. Then he crossed *Paeonia delavayi* with *Paeonia moutan* and got the very famous La Lorraine, which was the first tree variety with big balls of a bright yellow color. Other varieties followed with the result that we now have a group of tree peonies showing yellow and amber and red—L'Espérance, Surprise and Satin Rouge. He also crossed the herbaceous peonies and produced *P. albiflora* varieties such as Solange, Mme. Emile Lemoine, Mont Blanc, Baroness Schroeder, Le Cygne are but a few of the hybrids many of us enjoy in our gardens today.

He opened the way to the modern gladiolus by creating *Gladiolus lemoinei* through crossing *Gladiolus gandavensis* with *G. purpureo-auratus.* Then he created *G. nanceianus,* and finally the hybrid *Gladiolus primulinus.*

His first strain of gladiolus was shown at the Paris International Exhibition in 1878; but 21 years later he made such improvements in this flower that they have served as the basis for hybridizing ever since. He also hybridized the first double tuberous begonias. Among other flowers he worked with are: *Campanula persicifolia, Cydonia japonica,* pyrethrums, salvias, rhododendrons and azaleas, but no roses.

Eva Melady

Clematis jackmani is one of many fine hybrids with which Victor Lemoine worked for the enrichment of gardens

The work of the two Lemoines, Victor and his son Emile, touches so many plants it is hard to list all. We owe to them nine-tenths or more of all our modern lilacs, more than half our modern forcing hydrangeas, practically all our hybrid deutzias, syringas and weigelas, besides the many flowers previously mentioned.

In 1926 in the city of Nancy, France, there was a statue erected to the memory of the greatest breeder of ornamental plants the world has ever seen, Victor Lemoine. The statue is a shaft and bust for which contributions poured in from eleven countries. In the Golden Book, preserved at the rooms of the Nancy Horticultural Society, are the names of no fewer than 425 professional and amateur gardeners and societies who thus sought to do him honor as they would the memory of a great poet, artist or inventor.

LATE ROSES AND FRAGRANT ONES

Peter Malins

AT THE end of November 1962, more than thirty varieties of roses were still in good bloom at the Brooklyn Botanic Garden. A little frost had already touched most other plants. When picked, some of them lasted more than a week indoors, in water.

A list of those that withstood the first frosts of the season is given below. Since several of these were among the most fragrant of the roses in the Cranford Memorial Rose Garden, a list of all the especially fragrant kinds is also given. Five Hybrid Teas appear in both lists: American Home (rich blood-red), Arlene Francis (golden-yellow), Konrad Adenauer (carmine-red), Rose of Freedom (currant-red) and Tiffany (pink); also one Floribunda: Spartan (orange-red).

ROSES THAT CAN TAKE LIGHT FROST

Hybrid Teas

American Home
Arlene Francis
Butterscotch
Eclipse
Gail Borden
Konrad Adenauer
Kordes Perfecta
Lady Alice Stanley
Living
Mrs. Charles Bell
Neige Parfum
Peace
Peaceport
Pink Peace
Red Radiance
Rose of Freedom
Royal Highness
Signora
Starfire
Sutter's Gold
Texas Centennial
Tiffany
Tropicana
Valiant
Vanity Fair

Floribundas

Betty Prior
Fanfare
Fashion
Pinocchio (climbing)
Red Wonder
Spartan
Yellow Pinocchio

Grandiflora

Queen Elizabeth

FRAGRANT ROSES

Hybrid Teas

Aida
American Home
Angel Wings
Arlene Francis
Arpege
Avon
Charles Mallerin
Chrysler Imperial
Crimson Glory
Heart's Desire
Konrad Adenauer
Mirandy
Rose of Freedom
Rubaiyat
San Fernando
Tiffany

Climbing Roses

Aloha
Coral Dawn
Crimson Glory
Don Juan
Golden Showers
Spartan
Talisman

Floribundas

Capri
Gold Coast
Gold Cup
Ivory Fashion
Ma Perkins
New World
Pink Chiffon
Spartan

Old Roses

Frau Dagmar Hartopp
Nymphenburg
Stanwell Perpetual

FOUR FLOWERING PLANTS IN THE SPACE FOR ONE

Planting "four deep" provides extra bloom in small gardens

Elsie Louise Sculthorp

MOST of us gardeners are plant collectors at heart. We covet all the lovely things we see in the catalogs, nurseries, and the gardens of our friends. We want everything we like, and we like much more than we have room for.

But even though a small garden limits the size of our collections, it does seem the best kind to have. We can keep a small place in order by ourselves and we can fill it with choice and favorite plants that will give us more intimate pleasure than several far-flung acres. And we can get a surprising number of different flowers in limited space if we plant "four deep." By careful planning, we can have four times the amount of flowers we usually grow in a given space. Under the four-deep theory, each area selected for such planting bears at least four crops of flowers yearly.

Here's a sound way to approach the problem. First, there is the key plant to consider. This is the plant of particular interest. It gets first priority. Usually it will bloom in late spring or early summer. Second, a companion plant is chosen. Third, a bulb is decided upon which will endure this crowded condition and will produce flowers at another season. Finally, a well-mannered, low-growing plant of light foliage is needed so it will not crowd out or smother the companion plants. This one might bloom when the other three have finished or, if harmonious in color, it could bloom along with one of the others.

There are endless possibilities, but there must be a few rules. The plants that are used should be permanent, long-lived, and deep-rooted perennials. We shouldn't select biennials, unless we want to rest part of the group annually. Some of the biennials, however, such as foxgloves or sweet William, may be exactly what we need in a certain space. And some catalogs list perennial foxgloves.

It would be wonderful if all the flowers in a four-way planting could be set out at the same time. But this cannot be done, so you plant what you can when you can. The combination of peonies and bulbs serves to illustrate the problem. September is the month for planting peonies.

The daffodil and lily bulbs should be planted in October. They can be set close to the peony roots. Anemones can be started from divisions in spring, or from root cuttings any time during the growing season. Pot-grown plants from the nursery can be set out any time you can get them. The ground cover, silene, is usually grown from seed planted in spring.

To help you work out some four-deep plantings, here are a few beauties that combine well. [Blooming dates are for northeastern United States and areas with similar climate.]

Key plants: Leopardbane (*Doronicum*), yellow daisies blooming in May. Bleeding-heart (*Dicentra spectabilis*), pink-to-red heart-shaped flowers, May to summer. Gas-plant (*Dictamnus*), white or rosy-pink racemes in June and July. Bellflower (*Campanula*), white or blue bells in summer. Plantain-lily (*Hosta*) in variety, blue or white spires in summer.

Companion Plants: Fringed bleeding-heart (*Dicentra eximia*), flowers in summer. St. Bruno's lily (*Paradisea liliastrum*), white

Condensed from *House Beautiful*, September 1962

sprays of flowers in June. *Thermopsis caroliniana*, yellow lupine-like flowers in racemes in June-July. Oriental poppy (*Papaver orientale*), pink, salmon, white or red blooms in June. *Cimicifuga racemosa* or *C. simplex*, white cloudy spires, in summer. Balloon-flower (*Platycodon*), blue or white, in summer. Meadow-rue (*Thalictrum*), yellow or lilac, summer. These are all able to stand crowding. Choose those that are similar to the key plant in cultural requirements.

Bulbs: These need not be only daffodils or tulips. Any plant will do that has a fleshy root which shoots up quickly to bloom and then rests until its next flowering season. The small bulbs such as crocus, snowdrop, scilla, chionodoxa, muscari, and species tulips are excellent and may be planted as a prelude to any combination. Here are larger plants that will also serve. *Fritillaria imperialis*, orange and yellow, blooms in April. Leek lily (*Allium moly*), yellow, blooms in May. *Camassia*, blue or white, blooms in June. Desert candle (*Eremurus*), white, pink, salmon, yellow, very tall, blooms in summer. Hardy amaryllis (*Lycoris squamigera*), pink lily-like flowers in late summer.

Ground covers: These, as said before, should have a rather open habit and light-textured foliage so as not to smother the companion plant. There are many annuals that fill the bill, such as forget-me-not, sweet alyssum, verbena, and annual phlox. If you want a perennial ground cover for a shady spot, try epimedium. It has the right foliage density, it holds its leaves all season and is always handsome.

If you should want the effect of the large foliage, consider some of the hostas. They are old-fashioned, but endlessly useful. Two of the best for combination plantings are the fragrant white August lily (*Hosta subcordata grandiflora*) and *Hosta minor alba*.

Beyond the usual cultural requirements for the plants you choose, there is the one added requirement. With several groups of plants competing for sustenance, it is wise to prepare the planting bed thoroughly and give the plants regular feedings.

A GARDEN CONTAINING NO PLANTS

STONE GARDEN OF THE RYOANJI TEMPLE IN KYOTO, JAPAN

Replica of this garden without plants and one wing of adjacent Buddhist temple are under construction at the Brooklyn Botanic Garden. Dedication ceremonies are scheduled for May 1963. The Ryoanji garden is an abstract composition, consisting of a bed of what appears to be coarse sand, skillfully ripple-raked to suggest the sea, and set with 15 stones in five groups, no two stones and no two groups alike. The design, which has been attributed to a Zen priest of some five centuries ago, was created for quiet contemplation and meditation.

WHAT IT WILL TAKE TO MAKE AMERICA BEAUTIFUL

An interview by U.S. News & World Report *with Conrad L. Wirth, Head of the National Park Service*

Q Mr. Wirth, is America losing its beauty?

A It's down at the heels in places, no question about that. But America is still the most beautiful country in the world—great natural beauty all around us—if only we would take care of it.

Q What seems to be the trouble?

A People are the main trouble. They are rushing away from the land, ignoring its beauty. We're so busy keeping up a frantic pace in our cities that we scorn what we should be enjoying.

Q How does that show up?

A Take a look around. We've let people build mountains of junk all around us. Near every city you find great dump heaps of broken cars—no matter what entrance you use to the city. Or take a drive—you can hardly see grass or flowers in some places because of the discarded beer cans. And you can get mighty tired looking into mile after mile of glaring neon lights. Then drive farther along and look for scenery along the highways. In a good many places you can't see past the billboards.

Q Are you saying that people just don't care?

A That's part of it. A lot of people have lost their regard for nature. I firmly believe that most people have forgotten that the food we eat, the clothes we wear and the shelters we're under come from the good earth. We just take everything for granted. One of our biggest troubles is with our children. City children don't have any idea of what they are missing. If we could get them out in the country where they'd get some good, clean dirt in their toes they'd know more about their nation.

Q You mentioned highways. Are they a special problem?

A Definitely. We have destroyed a lot of wonderful scenery by slapping our high-speed roads down the fastest routes, regardless of anything else. If our highways were designed to be scenic, as well as to get you from one place to another at reasonable speeds, we would see a tremendous lot of pretty country that we're missing. And don't forget, the largest part of our highway travel today is recreation travel, not business travel.

Q What can be done about that?

A If enough people complain, the responsible authorities—I would hope—might change their thinking about how highways should be designed.

Secretary of the Interior Udall and I made a statement on the federal-aid-to-highways bill, and what we said was roughly this: "We need these new highways, they're fine, but let's wind them around a little bit so they go to different spots. Let's not destroy historic objects or fine scenery; let's make it available for people to enjoy."

Q Are billboards considered a real problem?

A They are when they are not controlled.

Q Do you have a solution to that?

A I'd like to see orderly billboard displays. I'd zone highways by sections. In some sections, no billboards at all. In others, of course, they are needed for commerce and information. Say you are approaching a city. I'd have an orderly

*Editor's Note: There may be an even heavier schedule ahead for this nature center. At the Brooklyn Botanic Garden, school classes are booking guided tours a year and more in advance.

Condensed from a copyrighted interview in *U. S. News & World Report*, August 13, 1962

billboard display of a kind that would tell you about hotels, shopping areas and whatever else you need to know.

Q What kind of example is the Federal Government setting when it puts a federal highway in?

A I've seen reports on highways that have actually said: "This is the best location for this road because you can go from here to there in the shortest time. We have not considered the cultural, social or economic values on the communities in our study."

Q You mean the highway in that case would go right through a park or a historic site, if it's in the path of the straight line—and if no one else considered the consequences?

A That's precisely the kind of thing that is happening today in many places.

Q Is the trouble only with the highways?

A By no means. A lot of it is right in the cities. Take flowers, for example. When I first came here 28 years ago, Washington had quite a few public flower beds. But there are few flower beds now, by comparison. I would like to see us go back to planting flowers and getting some color into our towns—a breath of freshness across the whole country.

Q Why did they stop using flowers?

A Well, it was an effort to cut down the cost of maintenance. They converted to shrubs. But sometimes I'm not so sure that we've saved any money.

When you come right down to it, when you start replacing shrubs every two or three years, you spend a considerable amount of money. You have to keep them trimmed. Some are clipped hedges. But, of course, money wasn't the only reason. We had the kids running through them, and people coming by and picking up the plants and cutting the flowers—it got a little discouraging over the years. So we went to shrubs.

Q How about window boxes in city office buildings, in front of homes—would that help brighten things up?

A I think that's excellent. In Minneapolis, where I was brought up, nearly every house up there, as I recall, had window boxes. Even the lampposts, they used to have boxes around them with flowers growing out of them. It gave you a feeling of freshness and life.

Q What can cities do to make their parks more attractive?

A There is one thing that's happened here in Washington that is worth mentioning as an example. Under our Mission 66 program we built a nature center in Rock Creek Park. It's built for children and it has animals, plants and a small planetarium. And you know, that nature center is now being booked up for as many as three or four weeks in advance.* The schools are bringing their classes in there in droves. That gives me a great deal of satisfaction.

The only complaint we get is from some fathers and mothers that we're making them look silly because the children are getting to know more about the plants and the birds than they do.

Seriously, though, I think if we develop that kind of thing, we are going to have a better nation in the next generation and the generations to follow. After all, we're only custodians of this country as long as we are alive, and we've got to hand it on to the youngsters in as good shape as we can.

Q Is there anything to be done with dumps for junked cars?

A I know what I'd do with them. I'd abolish them. I would take those old cars and strip them, compress them, and dump it all out in the middle of the Atlantic Ocean where it wouldn't be seen. It would be down there for a long time but you would never fill the ocean up. I think they're absolutely horrible. I don't see why we permit it.

Q Why is it permitted?

A Because we don't think enough of our neighbors. Ugliness doesn't bother some people at all. But the fact that it does bother others ought to be the controlling circumstance. Unfortunately, ugliness wins out all too often.

Q Mr. Wirth, are there some areas

where the face of the community is being made a bit more handsome?

A Oh, yes. Take the beautification that we have noticed in front of homes. There has been a growing trend for areas in front of houses to be landscaped beautifully and kept beautifully.

My analysis is this: We have given people more of an opportunity to be homeowners. You take much better care of property when you own it.

Q Do you find any encouragement in the trend to landscaping of industrial construction in outlying areas?

A Yes, and I'd like to see more of that encouraged—placing a building in a parklike atmosphere. Some insurance companies have taken the lead in that.

Q Could the same be done with steel mills?

A I think it could. Steel mills have a lot of smoke and stacks, but the approaches, at least, can have green grass and trees. The ugliness of anything can be screened out to a certain extent.

Places of work set in a parklike atmosphere have happier employes. They tend to be more efficient. The atmosphere is more pleasant, more conducive to better work.

Q Is there something about the American character that causes us to pick other people's flowers, or throw beer cans out of windows?

A I'd like to see this flaw removed from American conduct. It's a matter of education. Perhaps our schools or, more likely, we the parents, are falling down on the job—or were falling down. Actually, I think there is a sharp trend now in the other direction, toward taking more pride in our natural surroundings. Conservation groups of various kinds are hard at work. Private citizens seem to care a lot more. Things are looking up.

Q Is there any national organization that is dedicated to the idea of beautifying this country?

A Not any single co-ordinating organization as such. There are different groups. "Keep America Beautiful" is one you may know. It's financed by manufacturers, some of whom have been criticized in the past. You don't see the "throwaway" glass bottle any more—not the word "throwaway" anyway. And some of the gasoline companies in their advertising emphasize conservation.

Q But is there no board or commission devoted to the beautification of this country?

A No, not as such. I think that is an idea that could very well be explored.

Q The Mission 66 program you mentioned earlier—is that nationwide? Exactly what is the goal?

A Mission 66 is nationwide, all right. It's our big program for the National Park Service. The idea is to keep up with the demands being made on our national parks.

Q Are you making progress?

A We are doing very well. Congress understood the value of an orderly, long-range program.

Q How many people do you handle in the national parks now?

A We accommodated 79 million last year, and we'll hit close to 100 million by 1966. You see, we were overly conservative in Mission 66.

Q Have you got accommodations now that can handle 79 million people in the parks?

A We have done this in the parks: All of our concessions are under contract, financed with private capital. Our hotel and motel accommodations and feeding establishments are geared to handle whatever business there is. We still need a lot of construction to improve the existing park-road system. Yellowstone has 2¼ million acres.

Q How many national parks are there?

A Thirty. But let me finish my Yellowstone story. Do you realize that we haven't got a single additional mile of new road in Yellowstone than we had during the stagecoach days? If you assume that a road influences a quarter of a mile on each side, or a half-mile strip of land, we're able to use only 5 per cent of our total land in Yellowstone for roads.

I HONESTLY feel that how we provide for the use of our leisure time is going to determine the kind of country we have tomorrow. Look at it as a character-building proposition, if you want to. I believe that open spaces make better citizens.—CONRAD L. WIRTH

Q Why haven't you expanded the facilities and the roads there?

A We have expanded, but not miles of roads. You space your campgrounds out, which we have done, and you still find, with some exceptions, people putting their camps right on top of one another. They're so doggone used to living close to people in the city that they don't want to be separated.

Q If you wanted to take a pack and walk into some of your 2¼ million acres of Yellowstone—set up a camp all alone off the beaten track—could that be done?

A Yes. That's what we're trying to encourage. If we can get people out of their cars and out on the trail, that's all to the good.

Q You mentioned 30 parks. What else does the National Park Service control?

A There are 192 areas in the system. Thirty areas are called "parks." The rest are national monuments, historic battlefields, historic sites of various kinds and recreation areas.

Q How much land do you have in those 192 areas in the national-park system?

A About 26 million acres.

Q How much additional land do you have in mind for additional sites or for enlarging present areas?

A I don't know what the acreage will come to, because we don't really measure the system in acreage. If it is a scenic, historic or recreational area that is of national importance, then we figure out how much land is needed to preserve that. We have only a few more additional national-park areas to add—that is, the really big acreage.

I would say that eventually the ultimate size of the national-park system—that includes all the historic areas that are coming in—would come up to, perhaps, 275 areas, as compared with what we have at the present time.

Q Are you interested in preserving sites along rivers for parks?

A Very much so. I think we ought to hold a certain amount of land along all of our free-flowing rivers, lakes, along the seashore. I'm not one for taking everything, but I do think we ought to have reasonable frontage for those people who can't buy along the water.

Q Would that be federal land?

A Not necessarily. I think the only areas the Federal Government should be interested in are those of outstanding national scenic or scientific or historic or recreational value. I'm talking about areas that are of just as much interest to a man from California as to a man from Massachusetts.

Q You don't consider it a luxury?

A I don't think recreation and enjoyment of nature are luxuries any longer. I think they are a requirement of our way of life here in America.

This is a beautiful country. We've got the prairies, we've got the seashores. Mountains like the Sierras or Alleghenies are God-given. We've got glacial country and desert country. We've got every kind of natural beauty there is.

And here we are, building highways zooming down through our beauty spots, carrying millions of people out from the cities—and where are they going? I'll tell you—they're racing back and forth from one end of the highway to the other, from one filling station to the next. That's not what nature intended for any of us.

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IF YOU HAVE A BOG . . .

Here is how government agencies will help you

LANDOWNERS in the Northeast who have wet, poorly drained sites an acre or more in size can get government help to develop these areas into marshes. They are seldom good for anything else.

A marsh furnishes food and shelter for many kinds of wildlife and birds, especially waterfowl. It gives the landowner an attractive setting of natural charm. It can be embellished with wild flowers, rock gardens and nature walks.

The United States Soil Conservation Service (S.C.S.) provides free technical help. Soil scientists first check their maps to determine if the landowner's site is suitable for marsh development. If it is, engineers design a dam to create a pond.

When there are funds available, the Agricultural and Stabilization Service (generally referred to as the A.C.P.) pays part of the development costs. A marsh is considered a good use of land—a basic conservation principle.

To set the wheels in motion, the landowner should get in touch with the supervisors of his soil conservation district or the local S.C.S. representative. Supervisors advise landowners to file applications in the fall or winter. By the time summer arrives, they will be in a favored position on the priority list.

In Connecticut, the S.C.S., the A.C.P. and the State Board of Fisheries and Game team up, in some cases, to help the landowner develop his site into a marsh. If the state board comes in on the project, the landowner signs an agreement permitting the board's biologists to manage the marsh for 10 or 20 years.

In such cases, the state board may pay part of the development cost. In taking part in the development, the board is governed by its budget, the value of the proposed marsh to waterfowl and the beneficial relation of the site to other waterfowl habitat in the area.—LESTER FOX

Condensed from the New York *Times*, November 4, 1962

NEW TREES MAKE A NEW TOWN OF ST. JAMES, MISSOURI

FINE trees are returning to St. James, Missouri. In this Ozark town of 2,500 population, once famous for its tree-lined streets, decrepit specimens are being removed and ornamental young trees are being planted in their stead. About 6,000 sweet gums, hollies and Hopa crabs have been set out in four years' time on public and private property. The expense has been met by the James Foundation, which administers a fund for the benefit of the town—a bequest from a granddaughter of one of the town's founders.

The plan is to double this amount of planting. Already St. James is confidently calling itself "The Forest City of the Ozarks." The entire tree-planting project is being managed by the town's Forest City Committee. The city government provides the administrative machinery for the work.

Several other projects have been inspired by the town's tree-planting. Among them is a flower-box program for business houses, organized by a junior club.

In November 1962 the City of St. James was given the Community Achievement Award of the Flower and Garden Foundation, in recognition of its achievement in the spirit of gardening.

Adapted from *Flower and Garden* magazine, December 1962

FROM DUMPSITE TO BOTANIC GARDEN

Sunset Magazine for August 1962 reports on how a landfill is being converted

OUT in Los Angeles County, California, a landfill operation is being turned into a botanic garden by an enthusiastic group of citizens. The site, in Rolling Hills, was a former open mine for diatomaceous earth. It was being filled by the County Sanitation Department over a seven-year period.

Before the job was half done, Mrs. Frances Young of nearby Hermosa Beach conceived the idea of converting the dump into a botanic garden. A group that she organized under the title of the South Coast Botanic Garden Foundation, Inc., drew up plans and made an agreement with the county departments of Sanitation and of Arboreta and Botanic Gardens. The latter gains control of each section as the fill is completed.

Advantages of this agreement's having been made at an early stage in the filling operation are several. The fill, which is covered with about two feet of soil, can be contoured according to specifications as the work progresses; trees can be planted at once on the filled-in sections, instead of all having to wait until the whole job is completed; and the expense of temporary planting for dust and erosion control can be avoided.

Meanwhile, the Foundation has enlisted the participation of almost every local community group—youth organizations, service clubs, chamber of commerce, nurseries, garden clubs, as well as individuals. Donations, of both money and plants, sustain the project. The first planting was made in 1961 on four acres, principally with 43,000 plants contributed by the Los Angeles State and County Arboretum at Arcadia.

"Citizens can work effectively with government agencies by contributing constructive plans for a definite program," Mrs. Young has observed. How this has been worked out in Rolling Hills will be explained to anyone who requests information of the South Coast Botanic Garden Foundation, Inc., 1037 Second Street, Hermosa Beach, California.

EDITOR'S NOTE—As encouragement to Rolling Hills: The Brooklyn Botanic Garden started its happy existence 52 years ago on the site of an ash dump.

HERBICIDES AND CONSERVATION

INDISCRIMINATE spraying of foliage along roadsides to kill out trees and shrubs that obscure the motorist's view also kills all the plants of esthetic value in the immediate vicinity. When the herbicidal sprays drift in the wind, ornamental plants and crops are frequently affected.

There is a way of confining sprays to the unwanted woody plants, leaving the native wild flowers, ferns, and attractive shrubs and small trees to grace the scene. This is by selective spraying of the lower 10 or 12 inches of the main stem of the shrubs or small trees to be eliminated. If the job is done with care, adjacent plants are then not affected, and if the plants are not in leaf there is no unsightly killing (browning) of the mass of foliage.

To promote this type of spraying the Connecticut Arboretum has issued a bulletin* containing recommendations. Suggestions are also given on the enlisting of citizen action to ensure the adoption of selective basal spraying along the roads and under power lines in every community.

In its saving of desirable native plants, even encouraging their growth through removal of weedy competitors, this method constitutes good conservation practice.

*Bulletin No. 13, available from The Connecticut Arboretum, Connecticut College, New London, Conn. (send 25¢).

SOIL AND WATER PROBLEMS OF SUBURBAN AREAS

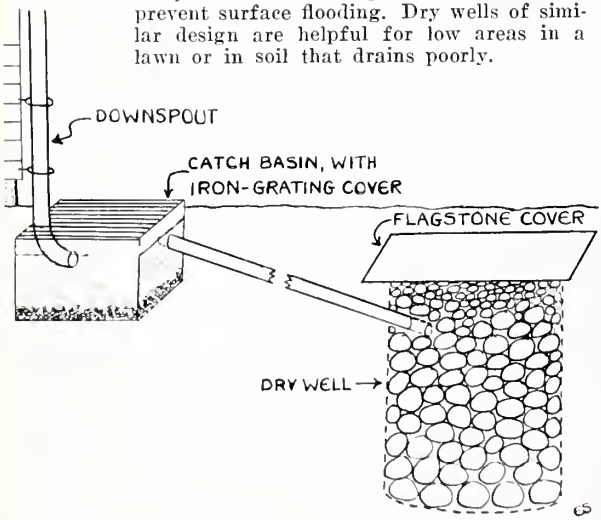
CONCENTRATIONS of people inevitably create problems of land use and protection. The natural landscape must be altered to make suitable conditions for people to live close together.

The natural regimen of soils and waters is upset when native cover is stripped away and replaced by roofs and paving. Runoff water behaves in new and sometimes violent ways when trapped in the rigid pattern of streets and gutters.

Suburban dwellers must cope with unnatural amounts and behavior of runoff water.

You see the results, for example, where the water pours off your roof into the flower bed. Before your house was built, the rain fell evenly over the ground it stands on. Most likely, a canopy of trees or mantle of grass kept the soil open and porous. Even in a hard rain, two-thirds or more of the water soaked into the ground as it fell. Now, it *all* comes pouring off the eaves.

Water that gathers in gutters and reaches the ground through a downspout in a torrential rush would, in nature, be spread gently over a large area. To carry it off the surface of the soil, so that its concentrated flow can do no damage, a catch-basin may be built. This, piped to a dry well, will carry rain water deep into the soil and prevent surface flooding. Dry wells of similar design are helpful for low areas in a lawn or in soil that drains poorly.



This effect is multiplied by every house in your neighborhood, and by every school building and factory.

The paved driveway to your garage, the walk to your front door, the sidewalk and streets all seal off additional areas. The parking lot at your shopping center alone renders acres of land surface impervious to water.

Fully built-up areas are likely to be more than half covered with buildings and paving. The land between has had most of its original surface soil removed or covered with raw, earthy material in excavation and grading. The traffic of builders' equipment and human feet has further compacted the soil and deprived it of its original capacity to absorb water.

As a consequence, runoff from built-up areas may be 2 to 10 times as much as from the same land in farms or forest. Your first conservation problem, therefore, is to dispose of this excess runoff with the least damage to your own property or to that of your neighbors. You may also have the problem of protecting your property against runoff from land above it.

Soil erosion makes many difficulties for the urban and suburban dweller.

The small size of your tract magnifies the seriousness of any loss of soil. You are rightly concerned over the appearance of a single gully or the caving of a bank.

Soil erosion occurs wherever water—either rainfall or runoff—hits bare earth. A new house ordinarily has much bare ground around it. The first occupant has the job of establishing a lawn and covering the scars of construction. Even years later there may be some critical area—a shady spot, steep bank, or drainageway—where grass refuses to grow and each heavy rain cuts away the soil.

Areas actually covered by buildings or paving, of course, are generally safe from erosion. But the abnormal runoff from

Soil Conservation Service, U.S.D.A.

Failure to plant grass or other ground cover on a slope can lead to destructive erosion.

these impervious surfaces concentrates the erosion hazard on the soil areas between.

The cardinal principle of preventing erosion is to have the grounds as completely covered as possible with growing vegetation (grass, shrubs, etc.), or with some substitute cover like mulch, burlap, flagstones, or gravel. Areas that must carry concentrated runoff need to be permanently paved or protected by special turfs, riprap, or other means.

From "Soil Conservation at Home—Tips for City and Suburban Dwellers," U. S. Department of Agriculture Soil Conservation Service, Agriculture Information Bulletin 244, available free to teachers, youth leaders and others upon request to any field, State or Washington office of the U. S. Soil Conservation Service..

CHEMICAL STERILIZATION OF INSECTS

DISCOVERY by U. S. Department of Agriculture scientists that several chemicals prevent reproduction in insects could lead to improved control or eventually aid in eradicating some of our worst pests.

According to a news release, the Department's Research Service entomologists report that certain chemicals induce sterility in houseflies, mosquitoes, stable flies, screwworms, boll weevils, and Mexican fruit flies.

By treating insects in laboratory-reared test colonies with minute quantities of sterilizing chemicals, the scientists succeeded in halting reproduction. Sterilized females laid no eggs, and the eggs laid by fertile females that had mated with sterile males did not hatch. The entomologists believe chemosterilization may be more effective than sterilization by radioactive cobalt.

The research chemists provided about 2,000 chemicals of which the entomologists found more than seventy that showed some effect on insect reproduction.

(The editors of *National Wildlands News* view this information with hope and optimism, for insect control by sterilization may replace dangerous poisons.)

Condensed from *National Wildlands News*, 2607 Connecticut Avenue, Washington 8, D. C., September 1962

THE CHESTNUT OF TOMORROW

Selected hybrids will replace the lost American species

Arthur Harmount Graves

IS the chestnut coming back? Definitely, yes, but not in the way most people think. The good old American chestnut seems to be gone forever. The fungus imported from China or Japan on oriental chestnuts some time in the nineties destroyed American trees which were defenseless against the attack. We can have them back only in a hybrid form in mixture with the blight-resistant Chinese and Japanese chestnuts.

The Chinese chestnut, *Castanea mollissima*, and the Japanese, *C. crenata*, will probably always be present in our future hybrids. As a general rule, their nuts are larger though not so sweet, and the trees are low—not fine tall timber trees as were our old American chestnuts.

After several methods of combating the dread blight had been tried ineffectually, I started breeding chestnuts in 1930 while a curator at the Brooklyn Botanic Garden, using as females various Japanese trees flourishing on Long Island, New York. Pollen from an old American tree near Washington, D. C., was sent by mail by G. F. Gravatt and Russell B. Clapper of the U. S. Department of Agriculture, who always worked closely with us. Some Japanese-American hybrids of this first generation contracted the blight after seven or eight years of growth, so we crossed them again with the Chinese chestnut, the most blight resistant of all species. Now, after about 25 years, during which time these hybrids have successfully withstood inoculation with the fungus, we feel confident that certain selected hybrids can soon be released for commercial propagation.

Dr. R. A. Jaynes, head of chestnut research at the Connecticut Agricultural Experiment Station, plans formal release of a few of these trees as well as two or three other promising hybrids as soon as scion wood is available. Presently, the station will issue a bulletin which includes information about the hybrids and general directions for grafting and culture.

B. W. McFarland

One of the promising hybrid chestnuts has been named 'Essate-Jap.' It is a cross between the southern chinquapin and the Japanese species. (Photo courtesy of Connecticut Agricultural Experiment Station.)

Three trees to be given to the trade are CJA's (C-Chinese, J-Japanese and A-American). 'Toumey' is a tall, erect-growing tree named for the professor who inspired this work, James W. Toumey of the Yale School of Forestry (1900-1932). 'Sleeping Giant' was named for the geological formation on which one of the plantations is situated. 'Hamden' was named for the township in which these trees are growing.

Three other trees under consideration are of different origin. 'Kelsey', a Chinese form with delicious nuts, is linked to a strain originated by Luther Burbank. 'Essate-Jap', a cross of the southern chinquapin (*C. pumila*) and the Japan-

Condensed from *Horticulture*, October 1962

ese, was crossed again with resistant Japanese. Dwarf Japanese-American, a small, prolific tree, is the result of continuous crossing of Japanese and American. It has sterile pollen and so cannot be used as a pollinator.

The chestnut tree, with rare exceptions, is self-sterile—a tree isolated from other chestnut trees will bear no nuts. Moreover, chestnuts cannot be propagated true to type from their own nuts. Twigs or scions of the desired tree, if grafted on some other chestnut, will grow into a tree like that from which the scion came. The production of blight-resistant hardy chestnut trees will stem therefore from such cultivars as 'Tourney', 'Sleeping Giant' and 'Hamden'.

This, at present, is the way in which the chestnut is "coming back."

During some of his early work in chestnut hybridization, Dr. Graves would keep old, diseased trees alive for continued breeding by grafting vigorous basal shoots onto the trunk above the region of infection.

This healthy hybrid chestnut, 23 years old, has reached 41 feet in height and 8.3 inches in diameter at breast height. Photograph by courtesy of Connecticut Agricultural Experiment Station.

B. W. McFarland

MIDWINTER BLOOM IN ENGLAND

A Botanic Garden Staff Member, returning home, reports on flowers that give winter display

Daphne Welch

A difference of ten degrees in average winter temperature can mean the difference between a flowerless and a flowery season. Whereas the principal winter interest in plantings around New York comes from the foliage of evergreens and the form of deciduous trees and shrubs, in the vicinity of London, where it is ten degrees warmer (on the average) there is considerable midwinter bloom.

To many persons, the term "winter flowering" implies only bulbous plants. This is natural, for the very fact that they have a reserve food supply underground is the reason why they are able to bloom ahead of other plants. There are, however, many shrubs whose beauty is enjoyed in England during the cold months.

Wintersweet, jasmine and witch-hazel, besides providing a pleasant splash of yellow, all have a strong fragrance. They are especially delightful when planted against the wall of a house.

Winter-aconites, always heralding the spring with bright yellow flowers above frilly green collars, can sometimes be seen struggling through a thin layer of snow. Following close upon these comes the much-loved snowdrop, each delicate white flower touched at the center with apple green.

It was interesting to me to find several clumps of hellebores in blossom, of varieties different from the Christmas-rose familiar in the United States; numerous cultivated hellebores, including several hybrids, bloom in England during the cold season.

Whatever the month one chooses to visit England, it will be possible to find a few blooms of yellow gorse. There is an old country saying that—

"When gorse is out of blossom
Kissing's out of fashion."

Even on the bitterest day in midwinter there will be a few straggling flowers. But they are not for picking; the protection afforded them on the plant by its hundreds of prickles is extremely effective!

To come upon the delicate beauty of *Prunus subhirtella* var. *autumnalis* flowering with complete disregard for the weather was a special delight. Not only does this flowering cherry bloom in the cold dark days of winter, but it later surpasses itself by producing another crop of flowers in late spring.

One of the little-known beardless irises (*Iris unguicularis*) thrives in quite dry soil with very little care. In return for a good supply of mortar rubble around the roots, it rewards one with blooms right through the cold weather, and brightens many dull corners in otherwise sleeping gardens.

At least two viburnums can be seen in bloom in winter in England. One (*Viburnum fragrans*) has fragrant, pale pink flowers clustered thickly on the bare stems. Leaves are not produced until later. The other one (*Viburnum tinus*), commonly called "laurustinus," is evergreen. Its flowers, produced in umbels, look like miniature editions of the mountain-laurel of eastern United States.

While out walking one December afternoon I suddenly caught a glimpse of yellow, and there, in the grass on a low bank, was a clump of primroses. They were an unexpected find, for they usually do not start to bloom until nearer Easter.

Ericas are often used as ground covers in woodland gardens. While at Kew I saw large areas of them, pink, yellow and white, all growing effectively among young birch trees. Early heaths bloom

Buhle

Winter-aconite sometimes blossoms through the snow.

during the winter and these are followed by other species of *Erica* which give a succession of color throughout the year.

Many other low shrublike plants as well as some herbaceous ones brave the cold weather. I saw evergreen candytuft, periwinkle, pansies, saxifrage and the ubiquitous English daisy. All of these bloom more profusely in the springtime, but they do, nonetheless, make a bright if meager showing on any mild winter day.

It is doubtful whether any of these plants that I have mentioned will bloom in January in the United States north of Zone 7 (from southern New Jersey through Washington, D. C., and southwestward), so the list which follows should not be taken as a guide for winter-flowering plants in New York or areas with a similar winter climate. My purpose has been merely to share with readers of *Plants & Gardens* a few of the plant discoveries which gave me special delight during my trip home. If you go to England sometime during the winter, may they give you pleasure, too!

EDITOR'S NOTE: For more detailed information on winter bloom in England, see "Colour in the Winter Garden" by Graham Stuart Thomas. (Charles T. Branford Co., Newton Center 59, Mass.)

PLANTS SEEN IN BLOOM IN THE VICINITY OF LONDON IN DECEMBER AND JANUARY

Anemone vernalis (similar to the pasqueflower)
Bellis perennis, **English daisy**
Berberis thunbergi, **Japanese barberry**
Bergenia cordifolia
Camellia sasanqua
Clematis alpina
Colchicum species and varieties, **autumn-crocus**
Crataegus monogyna var. *praecox*, **English hawthorn**
Crocus species and varieties
Eranthis hyemalis, **winter-aconite**
Erica carnea, **heath**
darleyensis
hybrida 'Silberschmelze'
mediterranea
multiflora
Galanthus elwesi, **snowdrop**
nivalis
plicatus
Garrya elliptica, **silk-tassel bush**
Geum species, **avens**
Hamamelis mollis, **Chinese witch-hazel**
vernalis, **spring-blooming witch-hazel**
Helleborus abchasicus, **hellebore**
angustifolius
kochi
niger
viridis var. *graveolens*
Iberis sempervirens, **evergreen candytuft**
Iris alata
unguicularis
Jasminum nudiflorum, **winter jasmine**
Lonicera fragrantissima, **honeysuckle**
standishi
Meratia praecox, **wintersweet**
Narcissus species and varieties
Primula polyantha, **polyanthus**
'Wanda'
vulgaris (*P. acaulis*), **common primrose**
Prunus subhirtella var. *autumnalis*, **rosebud cherry**
Rhododendron species and varieties
Rosa species and varieties
Ulex europaeus, **gorse**
Viburnum fragrans, **fragrant guelder**
tinus, **laurustinus**
Vinca minor, **common periwinkle**
Viola tricolor, **pansy**

IRRADIATED SEEDS

An expert appraises the possibilities of their giving rise to desirable new garden plants

IRRADIATED garden seeds have reached the market, most of them exposed to Cobalt 60 in one of the country's great atomic research laboratories. How do these differ from ordinary seeds?

Some individuals have exposed seeds to a dentist's X-ray machine, hoping to obtain some remarkable change, or mutation, in one or more of their progeny. What can the gardener really expect from such irradiated seeds?

Dr. Singleton, who has worked in this field since its beginning, shortly after World War II, tells here of the possibilities and difficulties of discovering a superior form in a plant through irradiation of seed.—ED.

W. Ralph Singleton

A GREAT deal of work has been done with irradiated seed. Some new and improved types of plants have been developed following the irradiation of seed or plants. However, one should realize that these improved types were produced by competent plant breeders who were trained for the job. The average home gardener does not have the facilities for growing enough plants to be able to select the rare or desirable mutant that may have been produced. It should be borne in mind that the beneficial mutant is rare indeed, regardless of the number of mutants induced.

Mutation itself is a rare event, even under the influence of radiation. In an irradiated seed packet containing 100 seeds from 1 to 10 per cent of the seeds would bring forth mutations (that is, a new inheritable type resulting in a change in the size or color of any part of the plant). However, of these seeds which do produce mutations, almost all the mutants will *not* be beneficial. In 100 packets of seeds containing 100 seeds each (10,000 seeds), experience has shown that only about one seed out of the possible 1,000 mutants will produce a beneficial change; that is, one out of 10,000 seeds. The other 999 mutant seeds may come up without green coloring and soon die, or appear spindly and perhaps not live to maturity, or grow in some other nonbeneficial way.

How many home gardeners are prepared to grow at least 10,000 plants in order to have an opportunity of selecting the one rare mutant? Even such a mutant might go undetected unless its advantage over the rest of the plants was obvious.

It was at Brookhaven National Laboratory at Upton, N. Y., that the first Cobalt 60 field was established for growing plants under continuous (chronic) irradiation. Much was learned regarding the usefulness of the gamma rays (similar to X-rays) from the radioactive Co^{60} in producing mutations in plants.

It was found that mutations in corn could be produced in great abundance. However, further examination of the mutants showed that they were nearly all less vigorous than normal and the chromosomes had been severely damaged. (Chromosomes are the rodlike bodies that carry the genes, the hereditary determiners.)

One of the most successful radiation programs is that of Walton C. Gregory at the North Carolina Experiment Station. He has produced new disease-resistant types of peanuts that are val-

Condensed from The New York *Times*, May 13, 1962

ned in the millions of dollars realized annually by the growers of North Carolina. Such feats as this make irradiated seed appealing to the home gardener. However, in the segregating generation Gregory and his associates looked at more than 1,000,000 plants growing on sixty-four acres. The whole program took more than ten years.

In the Co^{60} gamma garden at Brookhaven a large number of fruit trees are grown for workers in the various agricultural experiment stations near the laboratory. From these experiments have come new types of fruit. Some eventually will be made available to home gardeners as well as commercial growers.

In vegetatively propagated species any mutant that has arisen spontaneously or any that has been induced, may become a new variety because the mutant type can be propagated. It is not necessary to go through a seed generation where segregation would most likely occur. Perhaps for this reason radiation may have its greater usefulness in vegetatively propagated species.

I wish I could be more encouraging to the ardent home gardener who would like to become the discoverer of a new and revolutionary plant. I do not say it is impossible, but the probability is extremely low—much less than holding a winning ticket in the Irish Sweepstakes.

NEW WAYS TO AVOID DAMPING-OFF

Buhle

Seeds sown on top of fertilized potting soil, then covered with sand and medium chicken grit, developed healthy seedlings. No damping-off disease occurred among them.

COVERING SEEDS WITH a sand and chicken grit "mulch" is a simple means of avoiding damping-off in seedlings. Writing in *The American Horticultural Magazine* for April 1962, Alek Korsakoff of Miami, Florida, describes his method.

Using regular potting soil with a little dried manure added, he fills bulb pans to within 1½ inches of the top. He presses the seeds into this, sifts enough sand over them to barely cover them, and tops this with a quarter-inch or more of medium chicken grit. He places the pans outdoors in full sun, sprinkles them daily, and maintains that he has complete success with every kind of seed he has tried, "from Z to A."

A Combination Mix

A soilless mix that combines three well-known ingredients is recommended by the *African Violet Magazine* for June 1962. One part of sphagnum, cleaned and sifted, is used with two parts each of Perlite and Vermiculite. Flats should be well packed, then watered. African violet seeds may be sown on the surface; large seeds may be planted deep. For subsequent watering, use a very fine spray or set the flat in a pan of water.

Since this is a sterile medium, damping-off is not likely to occur. Growth is determined by the amount of fertilization: the first, given as seedlings emerge, should be half-strength. Further feedings are supplied 7 to 10 days apart, even after transplanting the seedlings into another flat of the same medium. When ready for soil, they should be husky plants with good root systems, well able to stand the shock of the final move.

ACID-LOVING PLANTS MADE TO THRIVE IN LIMY SOIL

A. G. Pannell

THE fact that lime-hating plants can only be grown in acid or completely lime-free soil has been frustrating for some years to landscape architects and parks superintendents because the two best-known of these, azaleas and rhododendrons, can provide the most brilliant colour display of any hardy shrub.

Some enthusiastic plantsmen have attempted to "beat the book" by importing large quantities of peat and growing the shrubs in that, but such attempts were only successful where the surrounding soil had very little lime in it. In most lime soils drainage water eventually reduced the acidity of the peat and the growth became stunted, the leaves often turned yellow and the shrubs had to be replaced.

It was this chlorosis or leaf-yellowing which suggested that the cause of the failure might be iron deficiency. The discovery by the Geigy Company of Sequestrene 138 Fe made it possible to supply the plants with iron for a full growing season following a single soil application in March.

Azaleas and rhododendrons growing in lime soils and in various stages of poor health have responded remarkably well to Sequestrene 138 Fe treatment, recovering on an average in four to six weeks after application. Some of the more badly affected plants needed a second application six to eight weeks after the first to assist their recovery. The difference between untreated and treated plants was: on the one hand, pale leaf colour, few or no flowers and few new shoots; on the other hand, the bright green leaf, abundance of new shoots and flowers expected of plants growing in an acid soil.

Trial applications of Sequestrene 138 Fe to lime-hating heathers (*Erica*) have resulted in very much improved growth and flowering, with leaves of a good green colour. Comparison plants left untreated have remained stunted, with yellow leaves and few flowers. Good responses have also been obtained with the related genus *Calluna*.

Magnolia is a tree which would be planted much more widely were it not for the fact that lime in the soil results in sparse flowering and scorching of the leaf edges. Growth is generally poor and there is sometimes leaf chlorosis. An improvement in leaf condition and general vigour has followed Sequestrene 138 Fe application in several trials.

Other calcifuge [lime-hating] plants which have responded to application of this new iron chelate included camellia, gentian, *Iris innominata, Kalmia latifolia, Lithospermum diffusum* and *Pernettya mucronata.*

When contemplating new plantings of calcifuge plants it is very desirable to work adequate quantities of peat or leaf-soil into the beds and especially into the soil replaced round the root ball at planting time. Improving the physical condition of the soil in this way will assist growth of healthy roots which can take up most efficiently the iron supplied by Sequestrene 138 Fe.

Sequestrene 138 Fe is supplied as a powder for addition to water; the mixture then being applied to the soil below the branch or leaf spread of the plant. Normal application time is March (after planting in the case of new beds) but it can be applied to established plantings which show chlorosis or stunting during the growing season. If the weather is dry after application, it is important to hose down the bed.

Condensed from *Gardeners Chronicle Gardening Illustrated*, London, February 10, 1962

WORTH READING

A Supplementary List of Significant Articles, Bulletins and Books Published During 1962

ARTICLES AND BULLETINS

Design in Gardens

Americans Discover the Pleasures of a Japanese Garden. Elizabeth Long. Color photographs of outstanding Japanese-style gardens across the country, including one designed by Frank Okamura of the Brooklyn Botanic Garden. *American Home,* September. 300 Park Avenue, New York 22, N. Y.

Landscaping Florida Homes. E. W. McElwee. Landscaping principles that are applicable anywhere, plus descriptive lists of suitable plants for widely varied Florida situations. Bulletin 179, University of Florida Agricultural Extension Service, Gainesville.

Gardening Practices

A Year of Plant Propagation. James S. Wells. Which garden plants to graft or propagate each month from March through December, with methods well described and illustrated. *The American Horticultural Magazine,* April. 1600 Bladensburg Road, N.E., Washington 2, D.C.

Propagating Bearberry Cuttings. Mrs. A. Sloan Mayo. Success and failure both are recorded by the writer, who followed a nurseryman's instructions. The previous month Mrs. Mayo described her successful transplanting of tip-shoots of bearberry (*Arctostaphylos uva-ursi*) from frozen sand to frozen soil without the loss of a plant. (A later attempt in higher temperatures was a total failure.) *Bulletin,* Horticultural Society of New York, February and March. 155 West 58th Street, New York 19, N. Y.

Foliar Feeding for Woody Ornamental Plants. This report from a bulletin of the Agricultural Experiment Station at Alabama Polytechnic Institute, Auburn, Alabama, tells of the value of foliar feeding as a supplement to soil fertilization, and of the differences in the responses of different plants. *Agricultural News Letter,* Spring. E. I. DuPont DeNemours & Co., Wilmington 98, Delaware.

How to Get the Most from Garden Catalogs. E. L. Sculthorp. Filing systems of catalogs and reference cards keeps information handy. *House Beautiful,* February. 572 Madison Avenue, New York 22, N. Y.

Summer Vacations and House Plants. Ernesta Drinker Ballard. Suggestions for home care *in absentia* and also for boarding services for plants. *The Gloxinian,* May-June. P. O. Box 608, Merrick, N. Y.

Plants for Gardens

Miniature Roses. Mrs. Alexander Pinney. Detailed directions for outdoor and indoor culture. *Bulletin,* Horticultural Society of New York, March. 155 West 58th Street, New York 19, N. Y.

Evergreens. Norvell Gillespie. Ortho Picture Guide of 48 pages, illustrated in color. Suggestions for selection, planting and general care of azaleas, rhododendrons and other broad-leaf as well as many needle-leaf evergreens. California Chemical Company, Ortho Division, 200 Bush Street, San Francisco, California. $1.

Grow Your Own Bird-Feeding Plants. Edwin A. Mason. How to landscape with shrubs and trees that will bring birds to the grounds. *Audubon Magazine,* May-June. 1130 Fifth Avenue, New York 28, N. Y.

Concerning Patents on Plants. Questions and answers in an eight-page supplement to *The Gloxinian,* July-August. Single copies available at 50 cents (10 cents each by the hundred) from the American Gloxinia Society, P.O. Box 608, Merrick, New York.

Trouble Control

Controlling Insects on Flowers. Floyd F. Smith. 80 pages, many photographs, four cover pages in full color. Agriculture Infor-

mation Bulletin 237. U. S. Department of Agriculture, Washington 25, D. C.

Diseases of Geranium. Paul E. Nelson. 10 pages, 26 photographs showing symptoms of diseases. New York State Flower Growers Bulletin 201. Available from Charles Wilton, Secretary, Prattsburg, Steuben County, New York.

Controlling Lawn Weeds with Herbicides. Directions for use, with list of weeds and their reactions to different herbicides. Bulletin No. A 1.77:79, Division of Public Documents, U. S. Government Printing Office, Washington 25, D. C. 10 cents.

DuPont Lawn & Garden Guide. 24 pages, illustrated in color, chiefly to show garden troubles and their remedies. E. I. DuPont DeNemours & Co., Wilmington 98, Delaware.

Eradication of Poison Ivy and Poison Sumac. J. F. Ahrens and E. M. Stoddard. Circular 222, Connecticut Agricultural Experiment Station, P. O. Box 1106, New Haven 4.

Nature and Conservation

Some New York Ferns. E. Laurence Palmer. Twenty-one species described and illustrated in color by H. Wayne Trimm. *The Conservationist,* State of New York Conservation Department, State Campus, Albany.

Pennsylvania Teaching Guide to Natural Resources Conservation. Eleanor H. Bennett. Basic concepts, with suggestions for demonstrating them to school groups from primary through high school grades. Also an abundance of reference material applicable in any state. Curriculum Service Series No. 7, Department of Public Instruction, Harrisburg.

BOOKS

Garden Design

An Amateur Gardening Book of Garden Plans and Designs. Edited by A.G.L. Hellyer. 127 pages, illustrated with plans and wash drawings. Collingridge, London. $2.55.

Lists of plants are especially appropriate for the British Isles, but designs of many kinds are applicable to gardens everywhere.

The Zen Gardens, Volume II. Toyo Okomoto and Gisei Takakuwa. Available from Perkins Oriental Books, 255 Seventh Ave., New York 1, N. Y. $6.50.

Fifteen world-famous gardens in Kyoto shown with several photographs of each. Explanations are in Japanese with an English translation at the back.

Persian Gardens and Garden Pavilions. Donald L. Wilber, 239 pages (7x10), 119 illustrations (23 in color). Charles E. Tuttle Co., Rutland, Vermont, and Tokyo. $12.50.

Gardens of today and of antiquity. Illustrations include many previously unpublished plans and details of old gardens.

Garden Practice

The New York Times Garden Book. Edited by Joan Lee Faust. 377 pages (7x10), photographs and drawings. Alfred A. Knopf, Inc., New York. $6.95.

Outstanding articles for year-round gardening activity, gleaned from the Sunday garden pages of *The New York Times.* Sixty-six authors represented.

The Golden Book of Gardening. Frances Giannoni and Seymour Reit. 69 pages (8x10), photographs, drawings, and many colored illustrations. Golden Books, New York. $1.99.

Basic information for inexperieneed gardeners, whether young or old. Simple directions given for making many kinds of gardens and taking proper care of them.

A Book about Soils for the Home Gardener. H. Stuart Ortloff and Henry B. Raymore. 189 pages. Barrows, New York. $3.95.

The nature of soils and how plants make use of their soil environment precede a practical section on soil management. The soils in 15 geographical regions of the United States are described.

The Illustrated Book of Garden Pests and Diseases. Edited by T. H. Everett. 160 pages (7x10), ilustrated with drawings and photographs, some in color. Hawthorn Books, New York. $5.

Practical answers to problems encountered outdoors and indoors by the average gardener.

Propagating House Plants—For Amateur and Commercial Use. Arno and Irene Nehrling. 282 pages, photographs and drawings. Hearthside Press, New York. $4.95.

Comprehensive directions, plus a calendar of propagation dates and an alphabetical list of plants with the type of propagation recommended for each.

The Golden Guide to Flowers. Edited by John Strohm. 175 pages, illustrated with many drawings and photographs plus 16 plates in full color; pocket-size, paper-bound. Golden Press, New York. $1.

This useful handbook deals with annuals, perennials, bulbs, roses, soils, garden tools and diseases and pests and their control. Diagrams, tables and brief text.

The Saturday Morning Gardener. A Guide to Easy Maintenance. Donald Wyman. 236 pages, illustrated. Macmillan, New York. $7.50.

Tells principally how proper selection of plants (1000 are mentioned) can keep garden chores at a minimum.

How to Control Plant Diseases in Home and Garden. Malcolm C. Shurtleff. 520 pages, illustrated. Iowa State University Press, Ames, Iowa. $4.95.

The newest as well as the time-tested remedies for all manner of infections in plants, which are listed alphabetically.

Garden Book for the South. Cecil Blackwell and L. A. Niven. 188 pages, illustrated partly in color. The Progressive Farmer Co., 821 North 19th St., Birmingham 2, Alabama. $1.

Mostly on vegetables, berries and grapes, with many tables for cultural details and pest control.

Simple, Practical Hybridising for Beginners. D. Gourlay Thomas. 127 pages, illustrated. St. Martin's Press, New York. $3.95.

Outdoor Gardening in Pots and Boxes. George Taloumis. 236 pages, illustrated. D. Van Nostrand Co., Princeton, N. J. $5.95.

The Art of Training Plants. Ernesta Drinker Ballard. 128 pages, illustrated, Harper & Row, New York. $4.75.

The Home Owner's Tree Book. John Stuart Martin. 166 pages, illustrated, Doubleday, Garden City, N. Y. $3.95.

Garden Plants

The Complete Guide to Bulbs. Patrick M. Synge. 320 pages, 357 bulbs illustrated, 330 in color. E. P. Dutton, New York. $6.95.

The most comprehensive bulb book available. Both indoor and outdoor types are included, among them such groups as gladiolus, crocus, anemone, arisaema, cyclamen and others, with ornamental uses and cultural detail given.

The Peonies. John C. Wister, Editor. 220 pages, numerous photographs. The American Horticultural Society, 1600 Bladensburg Road, N. E., Washington 2, D. C. $3.50 in paper, $5.50 in cloth.

Herbaceous and tree peonies comprehensively covered. Lists include names of nurseries and dealers.

Shrub Roses of Today. Graham Stuart Thomas. 239 pages, 32 pages of illustrations by author, some in color. Phoenix House, London. 42 shillings.

Descriptions of old-fashioned and modern kinds, with cultural directions.

The World of Roses. Bertram Park. 242 color photographs by the author, unpaged (8½x11). E. P. Dutton, New York. $15.

The richly hued illustrations are followed by descriptions of the varieties shown. Brief historical introduction.

All About Vines and Hanging Plants. Bernice Brilmayer. 348 pages, illustrated, partly in color. Doubleday & Co., Garden City, N. Y. $5.95.

For indoors and out, in warm climates and cool. Lists and descriptions of species in 265 different genera.

You Can Grow Camellias. Mary Noble and Blanche Graham. 257 pages, illustrated in color and black and white. Harper & Row, New York. $7.50.

Species and cultivars of camellia described, culture in varied climates, where to see fine collections, and a long and useful list of kinds.

Ornamental Shrubs of California. Leonid Enari. 214 pages, illustrated. Ward Ritchie Press, Los Angeles. $5.95.

Keys and descriptions, with drawings, of exotic as well as native plants of horticultural value.

The Camellia Book. John Threlkeld. 204 pages, 38 illustrations, 8 in color. D. Van Nostrand Co., Princeton, N. J. $7.75.

History, botany, culture, propagation, hybridization, uses, and the future of the camellia, with extensive lists of species, varieties, and sources.

Tropical Plants and their Cultivation. L. Bruggeman. 228 pages, 292 illustrations in color. Viking Press, New York. $12.

Ferns, vines, annuals, herbaceous perennials, aquatics, cycads, palms, conifers, bamboos, trees and shrubs are treated in alphabetical order. Many kinds included are hardy

in all but the northernmost United States. Cultural needs are given for each plant.

Photo Album of Garden Plants. 750 plants illustrated with photographs. Transatlantic Arts, Hollywood-by-the-Sea, Florida. $5.25.

Planned as a "recognition guide" to garden plants in England, and compiled from photographs published in *Amateur Gardening* magazine. Notes prepared by Christopher Lloyd; selection of subjects by A. G. L. Hellyer.

American Rose Annual 1962. Edited by L. G. McLean. 201 pages, illustrated partly in color. American Rose Society, 4048 Roselea Place, Columbus, Ohio. $4.50.

Foliar feeding, viruses, factors in seed production in hybrids, etc.

Roses. Eric Bois and Anne-Maria Trechslin, translated by Jean W. Little. 128 pages (8 x 11), 60 full-page plates in color. Thomas Nelson & Sons, New York. $20.

History and mythology, culture, use, propagation, and breeding of roses; a list of outstanding varieties in France.

Roses in Color. Henry Edland. 71 pages, illustrated. Viking Press, New York. $3.50.

A Studio book from England, presenting two dozen varieties, with descriptive notes.

Roses: Pleasures and Treasures. Peter Coats. 128 pages (8 x 8), illustrated with drawings, halftones and color plates, boxed. G. P. Putnam's Sons, New York. $3.95.

Chiefly of historical and artistic interest, with concluding notes on culture and varieties in England.

Orchids. John W. Blowers. 129 pages, 18 color illustrations. St. Martin's Press, New York. $4.95.

Miniature Plants for Home and Greenhouse. Elvin McDonald. 274 pages, illustrated. D. Van Nostrand, Princeton, N. J. $5.95.

Rose Growing Simplified. John Milton. 128 pages, illustrated, partly in color. Hearthside Press, New York. $3.50.

How to Grow and Use Annuals. 80 pages, $1.95. ***How to Grow and Use Bulbs.*** 120 pages, $1.95. ***How to Grow African Violets.*** 64 pages, $1.75. ***How to Grow and Use Camellias.*** 88 pages, $1.95.

Sunset books, 8½ x 11 inches, paperbound, all extensively illustrated, partly in color. Lane Book Co., Menlo Park, Calif.

Arts and Crafts

Flower Arrangement Designs for Today. Edited by Helen Van Pelt Wilson. 262 pages and more than 150 photographs. D. Van Nostrand Co., Princeton, N. J. $5.95.

Successful flower arrangers contribute groups of compositions representing special themes.

Pressed Flower Pictures and Citrus-Skin Decorations. Ruth Voohreese Book. 228 pages, illustrated with 58 photographs by Louis Buhle (8 in color). D. Van Nostrand, Princeton, N. J. $6.95.

The making of panels and pictures with various dried plant parts. Full directions.

A Treasury of Driftwood and Dried Arrangements. Tatsuo Ishimoto. 125 pages, many photographs. Crown, New York. $7.50.

The author of two early books on these subjects encourages experimental compositions.

Flower Arrangements for Special Occasions. Jean B. Amer. 128 pages (8 x 10), 104 arrangements illustrated, 40 in color. Allied Publications, 4110 Hillsboro Road, Nashville 12, Tenn. $4.95.

Each page contains a picture and a paragraph giving directions for an arrangement for some holiday or other event, with emphasis on Christmas. Menus and recipes introduce each section.

Outdoor Lighting for your Home. Stanley Schuler. 192 pages, illustrated. D. Van Nostrand Co., Princeton, N. J. $5.95.

Standard techniques and original ideas for enhancing the garden scene with light.

The Dried-Flower Book. A Guide to Methods and Arrangements. 128 pages, 60 photographs (12 in color). Nita Cox Carico and Jane Calvert Guynn. Doubleday, Garden City, N. Y. $4.95.

Festive Decoration the Year Round. Dorothy Waugh. 160 pages, illustrated with diagrams by the author and with photographs. Macmillan, New York. $3.95.

New Techniques with Dried Flowers. Sarah Whitlock and Martha Rankin. 32 pages, 13 color plates. Hearthside Press, New York. $2.50.

The Art of Table Setting and Flower Arrangement. Sylvia Hirsch. 152 pages, illustrated, partly in color. T. Y. Crowell Co., New York. $7.95.

Wild Flowers and Trees

The Book of Trees. 2nd edition, revised and enlarged. William Carey Grimm. 487 pages (7 x 10), full-page drawings by the author. Stackpole, Harrisburg, Pa. $10.

The new edition describes some 300 trees (including a few exotics) and about 40 large shrubs in the eastern states, from Canada to Florida.

Make Friends of Trees and Shrubs. Alma C. Guillet. 285 pages, drawings by the author. Doubleday, Garden City, N. Y. $4.50.

The text gives both folklore and botany of many woody plants, which are illustrated in a vertical panel on each page.

California Desert Wildflowers. Philip A. Munz. 122 pages, illustrated with drawings, maps, and 96 color photographs. University of California Press, Berkeley, Calif. Paperbound, $2.95; cloth, $4.75.

Michigan Wildflowers. Helen V. Smith. 465 pages, illustrated with 228 full-page line drawings and 17 species in color by Ruth Powell Brede. Cranbrook Institute of Science. Distribtued by University Publishers, Inc., New York. $5.

Meet Flora Mexicana. M. Walter Pesman. 278 pages, 270 drawings by the author. Dale Stuart King, Six Shooter Canyon, Globe, Arizona. $6.

Contains much useful and interesting information, along with descriptions of plants that can be seen from the main highways. A colored map shows the vegetation zones.

Roadside Flowers of Alaska. Louise Potter. 590 pages, 250 drawings by Eva Melady. Published by the author and available from her at Thetford Center, Vt., or (June-August) Wasilla, Alaska. $4.75.

A color key, list of 36 field areas along drivable roads, dates of bloom in different places, geographical index, and indexes also by both common and botanical names will help the Alaskan traveler to locate and identify wild flowers along roadsides.

Flowers of the Holy Land. Bertha Spafford Vester (artist). Distributed by Doubleday, Garden City, N. Y. $2.

Seventeen delicate watercolors of plants in Palestine.

Plant Life of Palestine. Israel and Jordan. Michael Zohary. 261 pages, illustrated. Ronald Press, New York. $8.

Background information on the area's plant geography, ecology, etc.; not an identification manual.

Wild Flowers of the Transvaal. Cythna Letty (artist). 174 full-page colored plates. Text by Division of Botany, Department of Agricultural Technical Services, Pretoria. 362 pages (8 x 10). Distributed by Central News Agency, Ltd., Pretoria, South Africa. R8 ($11.20).

Trees of South Africa. Eve Palmer and Norah Pitman. 350 pages, many photographs and drawings, 31 color plates. A. A. Balkema, Amsterdam and Cape Town. Available also from Edwin A. Menninger, Stuart, Fla. $19.50.

Parks and Conservation

The State Parks—Their Meaning in American Life. Freeman Tilden. 496 pages, 80 photographs. Alfred A. Knopf, New York. $5.50.

These We Inherit: The Parklands of America. Ansel Adams. 103 pages (10¼ x 13½), 42 photographs. Sierra Club, Mills Tower, San Francisco. $15.

Public Gardens and Arboretums of the United States. Martha McMillan Roberts. 148 pages (8½ x 11), more than 200 photographs, 10 in color, depicting 71 outstanding public gardens. Holt, Rinehart and Winston, New York. $7.50.

Whose Woods These Are. Michael Frome. 338 pages, color photographs and maps. Doubleday, Garden City, N. Y. $5.95.

Distinctive features of 20 of the national forests are presented.

Of General Interest

The Education of a Gardener. Russell Page. 381 pages, 50 full-page photographs. Atheneum Publishers, New York. $10.

A personal memoir by a designer of many distinguished gardens on both sides of the Atlantic. Interestingly conceived and delightfully written.

The Flower World of Williamsburg. Joan Parry Dutton. 148 pages, photographs, 8 in color. Colonial Williamsburg, Williamsburg, Va. $4.95.

Her Garden Was Her Delight. Buckner Hollingsworth. 166 pages. Macmillan, New York. $4.

Enchanting biographical essays on a score of American women, dating from the early 1600's, whose devotion to plants has been noteworthy.

Mushrooms and Other Fungi: Their Form and Colour. H. Kleijn. 144 pages (8½ x 11). Nearly 100 species illustrated in color, with accompanying descriptive text. Doubleday & Co., Garden City, N. Y. $10.50.

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